Environmental Assessment

Wing Mountain Fuels Reduction and Forest Health Restoration Project

Coconino National Forest

United States Department of Agriculture

Forest Service

Southwestern Region

June, 2012

Prescribed burn on the Flagstaff District
USDA Forest Service, Coconino National Forest

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Content

List of Figures

List of Tables

Summary

Historically, ponderosa pine forests of northern Arizona were characterized by frequent, low-intensity surface fires occurring every 2 to 12 years. The historic fire regime maintained an open canopy structure and a variable, patchy tree distribution across much of the forest by thinning smaller trees (Moir et al. 1997, Covington et al. 1997). Prior to Euro-American settlement, ponderosa pine forests in the southwest were uneven-aged and consisted of fewer smaller diameter trees and a greater number of larger, older trees arranged in groups and interspersed with grassy openings. After Euro-American settlement, several conditions, including fire exclusion, livestock grazing, high-grade timber harvesting, and climatic events, favored dense ponderosa pine regeneration (Long and Smith 2000). Much of the older age classes were removed during the railroad logging era and subsequent high-grade timber harvesting. In 1919, an unprecedented regeneration event occurred, resulting in massive amounts of pine seedlings. Due to fire suppression, these seedlings continued to grow in dense stands, forming a closed canopy across much of the landscape and effectively inhibiting further regeneration of shade-intolerant ponderosa pine.

As a result of these factors, ponderosa pine forests of the southwest are now predominantly "even-aged" and consist of dense, overstocked stands of ponderosa pine with closed canopies and few trees less than 5 inches dbh or greater than 24 inches dbh. In addition, current forest conditions show changes in age and size class diversity, altered stand structure and species composition, changes in successional dynamics, altered insect and disease dynamics, decreased understory productivity and diversity, decreased tree health, growth and vigor, increased fuel accumulation and continuity, increased crown fire potential, and increased fire size and intensity (Long 2003).

In order to address these factors and increase the Forest's resiliency to insects, disease and high severity wildlife, the Flagstaff Ranger District of the Coconino National Forest has proposed the Wing Mountain Fuels Reduction and Forest Health Restoration Project (the Wing Mountain Project).

Chapter 1 – Purpose and Need

Document Structure

The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant federal and state laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into five parts:

- Purpose and Need: The section includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- Alternatives: This section provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes possible mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- Affected Environment and Environmental Consequences: This section describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource area. Within each section, the affected environment is described first, followed by the effects of the Proposed Action and the No Action Alternative, which provides a baseline for evaluation and comparison of the other alternatives that follow.
- Consultation and Coordination: This section provides a list of preparers and agencies consulted during the development of the environmental assessment.
- Appendices: The appendices provide more detailed information to support the analyses presented in the environmental assessment.

Additional documentation, including more detailed analyses of project area resources, may be found in the project planning record located at the Flagstaff Ranger District Office in Flagstaff, Arizona.

Background

Location

The project area is located northwest of Flagstaff, Arizona (Figure 1), within the Wing Mountain 10K Ecosystem Management Area and is entirely within the wildland-urban interface (WUI) due to its proximity to private land and infrastructure. The project area encompasses approximately 11,143 acres; eighteen of those acres are in private land and 48 acres are part of the Fort Valley Experimental Forest. The project area is within the Community Wildfire Protection Plan (CWPP) developed by the Greater Flagstaff Forest Partnership and the Ponderosa Fire Advisory Committee (2005)[1]. To the northeast, the project area borders the Kachina Peaks Wilderness and Arizona Snowbowl ski area. To the southeast the project borders the Fort Valley Experimental

[1] The CWPP is a collaborative planning and implementation tool that helps mitigate immediate fire hazards to communities at risk, and restore fire-adapted ponderosa pine forests in the area (more information on the CWPP, see the project record or go online to www.gffp.org)

Research Forest, and private lands. The other areas of the project border Forest Service lands. Elevation ranges from approximately 7400 to 9200 feet.

During the fall of 2010, several tornado events took place in and around the Wing Mountain project area. The event has left a hazardous level of slash on the forest floor that could pose a severe threat if left untreated or unmanaged. The Post-Tornado Resource Protection and Recovery Project (2011) analyzed the effects of the tornados in relation to fire hazard and bark beetle infestation, and the decision authorized removal of debris and thinning treatments within a defined "buffer" zone if necessary to mitigate the spread of bark beetle infestation. Several historic fires have also occurred within the project area, including the Whitehorse Fire (1967), the Fort Valley Fire (1948), the Pipe Fire (2000), and the Trick fire (1993).

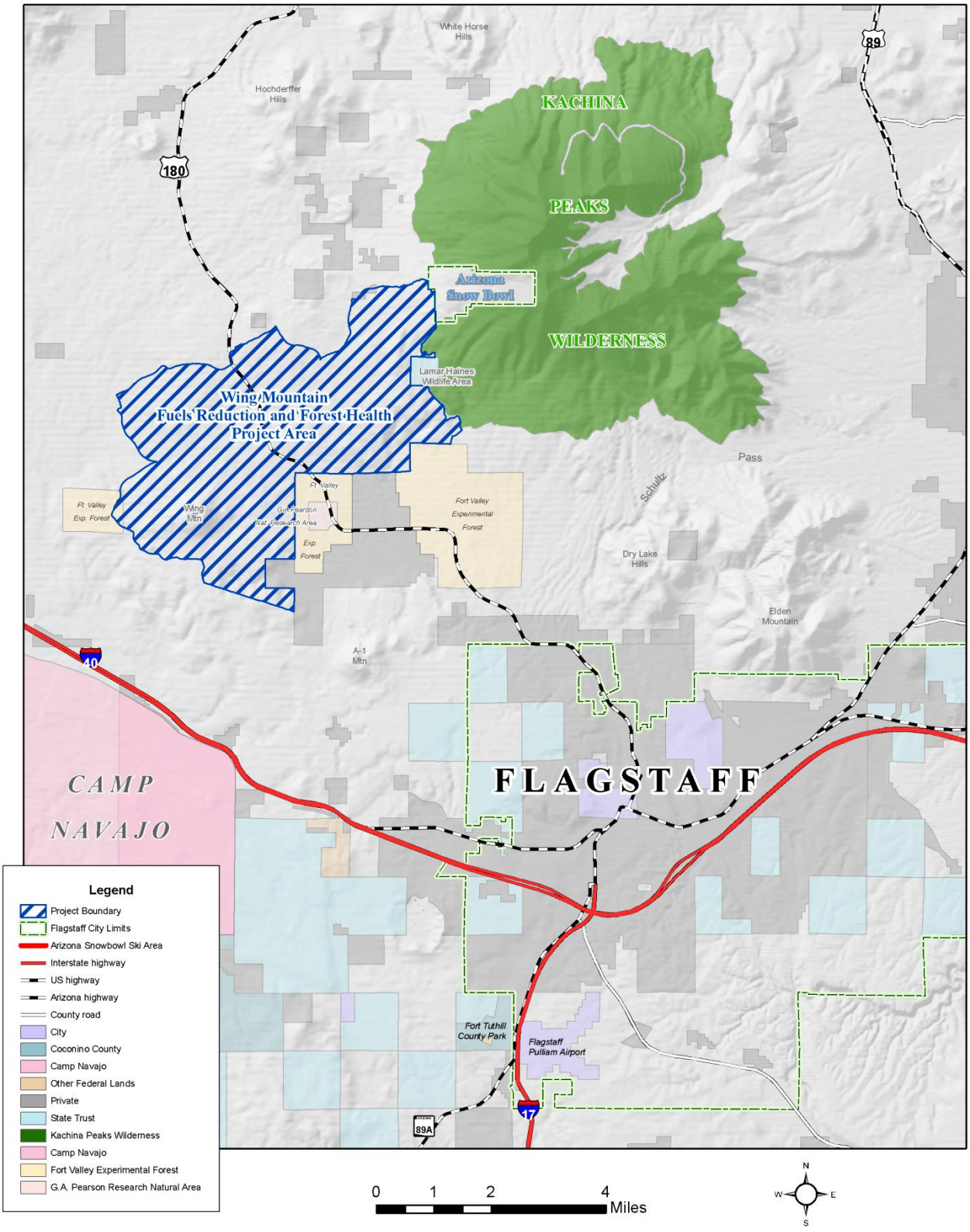


Figure 1: General vicinity map of the Wing Mountain project area

Vegetation types

This project is predominately ponderosa pine forest, with two areas that also contain significant amounts of mixed conifer and aspen. The vegetation cover types within the project are displayed in Table 1. Wing Mountain itself, which is approximately 8500 feet in elevation, contains approximately 160 acres of mixed conifer, most of which is located on the steep north facing slopes. The remainder of the mixed conifer, approximately 600 acres, is located on the western slopes of the San Francisco Peaks along the eastern edge of the project area. These two areas are also where the majority of the aspen within the project are located. There are some predominate aspen stands that occur in the mixed conifer and within high elevation ponderosa pine, and on north facing slopes within the ponderosa pine at lower elevations. Appendix B lists Management Area (MA) within the project area and the respective acres in each.

Table 1: Cover Types located within the Wing Mountain project area

Cover Type	DESCRIPTION	ACRES
TPP	Ponderosa Pine	9196
TAA	Aspen	272
TDF & TLI*	Mixed Conifer	768
GRA	Grassland/Meadow	835
WAT	Water	10
NFL	Non-Vegetated Sites	44

*TDF = Douglas Fir, TLI = Limber Pine

Historical conditions

Ponderosa pine and dry mixed conifer forests of northern Arizona were historically characterized by frequent, low-intensity surface fires occurring every 2 to 12 years in ponderosa pine and every 3 to 21 years in mixed conifer. This historic fire regime maintained an open forest structure with variable, patchy tree distribution by thinning many of the smaller trees before they grew large enough to become fire-resistant (Moir et al. 1997, Covington et al. 1997). The forests were uneven-aged and consisted of few small diameter trees and a greater number of large, older trees arranged in groups and interspersed with grassy openings (Moore et al. 2004; White 1985). Trees were arranged in groups of 2-40 trees up to 0.7 acres in size (White 1985; Fule et al. 1993).

Current Conditions

After Euro-American settlement, several conditions, including fire exclusion, heavy livestock grazing, high-grade timber harvesting, and climatic events, favored dense ponderosa pine regeneration (Long and Smith 2000). As a result, the current forest structure is predominately even-aged and consists of dense, overstocked stands of ponderosa pine with a closed canopy. Changes in historic fire regimes over the past century have resulted in increased conifer densities, surface fuel accumulation, increased fuel continuity, changes in age and size class diversity, changes in successional dynamics, altered insect and disease dynamics, decreased understory productivity and diversity, decreased tree health, growth and vigor, increased crown fire potential, increased fire size and intensity, and pine encroachment into meadows, aspen stands and drainage bottoms (Long 2003). Historical photographs, accounts, and maps indicate that there has been a dramatic reduction in the extent of meadows since the early 1900s.

Even-aged forests are susceptible by their nature to catastrophic disturbances such as stand-replacing fire and insect epidemics. Most of the project area shows a significant departure from historical conditions, and a wildfire occurring under existing conditions would result in more severe effects than would occur under the historical fire regime. In addition to the ecological impacts of these changes, there is an increased risk to firefighter and public safety with the potential for extreme fire behavior. Wildlife habitat and threatened and endangered species and indicator species in the project area are also at risk due to the existing conditions. The communities within the Wing Mountain project area are currently at risk from a wildfire and were included in the Community Wildfire Protection Plan for Flagstaff and Surrounding Communities (2005).

Table 2: Existing and desired Vegetative Structural States (VSS) for ponderosa pine at the stand level by percent within the project area

Vegetation Structural Stage (VSS)	Tree Diameter (dbh)	Existing % of Area	Forest Plan Desired % Distribution
1 – Grass/Forb/Shrubs	0.0 – 0.9”	2	10
2 – Seedling/Sapling	1.0 – 4.9”	1	10
3 – Young Forest	5.0 – 12”	37	20
4 – Mid-age Forest	12.0 – 17.9”	40	20
5 – Mature Forest	18.0 – 23.9”	14	20
6 – Old Forest	24”+	5	20

Table 3: Existing trees per acre, basal area and canopy cover by cover type across the project area

Cover Type	TREES PER ACRE	BASAL AREA (SQ FT / AC)	CANOPY COVER (%)	QUADRATIC MEAN DIAMETER (INCHES)
Ponderosa Pine	332	152	68	10.5
Mixed Conifer	627	181	72	8.4
Aspen	303	104	76	8.4

Table 4: Existing and desired fuel conditions across the project area

Measure	Existing	Desired
Average Height to Live Crown	7-18 feet	20+ feet
Average Dead and Down Fuel	7-14 tons per acre	5-7 tons per acre in ponderosa pine, 10-15 tons per acre in mixed conifer

Measure	Existing	Desired
Average Canopy Closure	68-91%	40-50%
Flame length	2-11 feet	Less than 4 feet

According to Forest ERA modeling data, existing crown fire potential for the Wing Mountain Project area is as follows:

Surface fire	665 acres	(6%)
Passive crown fire	3,531 acres	(32%)
Active crown fire	6,947 acres	(62%)
TOTAL	11,143 acres	

Thus, the majority of the project area has a greater potential for passive and active crown fire than surface fire. This result is most likely due to heavy fuel loadings, low crown base heights, high crown bulk densities, and high percentages of canopy closures across the project area when coupled with dry, hot, and windy weather conditions and terrain influences such as steep slopes and south to southwest aspects. The Fire/Fuels section of Chapter 3 contains more information on existing conditions within the project area.

Over the past 10 years, the majority of aspen sites across the project area have sustained greater than 60% aspen mortality (Fairweather et. al. 2008). Ground surveys revealed aspen decline is due to a range of factors including: a late season frost event; severe drought; defoliation by western tent caterpillar; and multiple secondary agents acting on stressed trees. The residual aspen trees are, in general, of poor health with reduced crown canopies. There is little evidence on the San Francisco Peaks of successful aspen recruitment over the last several decades due in large part to browsing by large ungulates and lack of wildfire. Widespread mortality of mature aspen trees, chronic browsing by large ungulates, and advanced conifer regeneration is expected to result in rapid vegetation change of many ecologically unique and important aspen sites.

Due in part to the large accumulation of dead and down material following the 2010 tornado events on the forest, bark beetle infestation is an ongoing concern within the project area. Severe dwarf mistletoe infection is also a forest health concern within the project area. The Vegetation and Forest Health section of Chapter 3 contains more information on existing dwarf mistletoe infection.

Desired Conditions

Desired conditions include a more open, variable, patchy forest structure that is sustainable, uneven-aged, and within the historic range of natural variability. Trees would be arranged primarily in groups of varying shape, size, and number of trees, with a mosaic pattern of individual and clustered trees interspersed among openings. The area would exhibit an increase in age class diversity, decreased canopy cover, decreased conifer densities, improved successional dynamics, increased and unsuppressed regeneration, increased old growth forest as a percentage of stands and increased vertical and horizontal heterogeneity. Desired future conditions of improved tree health and vigor, improved forest health, and a sustainable forest structure would promote a forest that is more resilient to insects and diseases. Other benefits such as improved hydrologic function, improved wildlife habitat, and improved scenic quality are expected from this type of restoration treatment. These desired conditions would be consistent with goals for

management of Threatened & Endangered species, specific management requirements for US Forest Service Region 3 sensitive species, and the Coconino National Forest Land and Resource Management Plan 1987, as amended.

The desired condition for Maxwell and Big Leroux Springs includes healthy, self-sustaining riparian vegetation around both springs.

The desired condition for fire hazard ratings is for primarily low to moderate hazard ratings across the project area. This includes a combination of increased height to live crown, reduced dead and down fuel wood load, decreased percent canopy cover, and decreased number of trees per acre that would minimize the chance of severe fire behavior occurring during the worst fire weather. Desired conditions also include reducing the threat of wildfire to adjacent values at risk, including urban areas and ecological and cultural resource sensitive areas, such as Gus Pearson Natural Area and Fort Valley Experimental Forest.

Purpose and Need for Action

Based on the comparison of the existing and desired conditions for the project area, there is a need to bring existing ecosystem conditions closer to desired conditions. The current dense nature of the vegetation contributes to an unacceptably high fire hazard. There is a need to move toward conditions that support natural and desirable fire behavior with healthy and sustainable forests, meadows, and watersheds. The goals as well as the purpose and need associated with this project are outlined below, followed by a brief summary of existing and desired conditions by key resource areas.

The primary goals of the Wing Mountain Project are as follows:

- Improve the health of forests and associated habitats
- Reduce the threat of severe wildlife in and around the project area

The current conditions and desired future conditions have indicated the following needs for action within the Wing Mountain project area:

- There is a need to reduce hazardous fuel loading and move toward conditions that support natural and low intensity fire behavior
- There is a need to restore a more diverse forest structure and species composition by creating a mosaic of interspaces and tree groups from even-aged forest stands and re-creating forest openings
- There is a need to move toward desired conditions of riparian ecosystems by having springs function at, or near, potential
- There is a need to manage for old age (pre-settlement) trees such that old forest structure is sustained across the landscape by moving toward forest plan old growth standards of 20 percent at a forest Ecosystem Management Area scale
- There is a need to move toward watershed desired conditions and soil function by decreasing current road densities

This action responds to the goals and objectives outlined in the Coconino National Forest Plan, and helps move the project area towards desired conditions described in that plan (USDA Forest Service 1987, as amended).

Proposed Action

To meet the project's purpose and need, the following activities are proposed:

- Ponderosa pine restoration treatments, including hand and/or mechanical thinning treatments followed by prescribed burning.
- Mountain grassland and pine savannah restoration treatments, including hand thinning or mechanical treatment followed by prescribed burning.
- Aspen restoration, utilizing a variety of treatments including conifer removal, prescribed fire, ripping, planting and/or cutting of aspen to induce root suckering.
- Spring restoration by constructing/maintaining ungulate-deterrent fences around Maxwell and Big Leroux Springs, as well as the re-plumbing and release of excess water at Big Leroux Spring.
- Road decommissioning and closures, including rehabilitation and obliteration actions

See Chapter 2 for more details on proposed treatments.

Decision Framework

Because the proposed action includes timber harvest exceeding the delegated authority of the District Ranger, the Forest Supervisor is the responsible official for deciding whether or not, and in what manner, lands within the Wing Mountain project area will be treated to reduce wildfire hazard and improve forest health.

Items in this decision will include:

- number of acres treated mechanically
- number of acres treated by hand thinning
- number of acres treated with prescribed fire
- treatments within the MSO Restricted habitat
- treatments within MSO PACs
- treatments within northern goshawk habitat
- construction of new temporary roads
- obliteration of existing roads
- restoration at Big Leroux and Maxwell Springs
- mitigation measures to avoid or minimize impacts to Forest Resources

The decision will be based on a consideration of the environmental and socioeconomic effects of implementing the proposed action or alternatives. The Forest Supervisor may select the proposed action, any alternative analyzed in detail, a modified proposed action or alternative, or no action. Should the Responsible Official determine that the proposal will result in significant effects, additional analysis may occur through the development of an Environmental Impact Statement.

Public Involvement

The proposal was listed in the Schedule of Proposed Actions from October 2010 to June 2012. The proposal was provided to the public and other agencies for comment during the 30 day

scoping period beginning on September 15, 2011. Scoping letters, including a link to the proposed action and purpose and need were sent as hard copies to 112 individuals and 21 personalized letters to tribal contacts, including 18 email contacts. A press release was issued from the Coconino National Forest September 20, 2011. Comments were accepted through October 18, 2011. In addition, as part of the public involvement process, the project description and proposed action were listed on the Coconino National Forest website at http://www.fs.fed.us/nepa/fs-usda-pop.php/?project=33853.

Elements of the proposed action were formed from on-going communication with other agencies and organizations that share an interest in the management of the project area, including Northern Arizona University, Arizona Game and Fish Department, US Fish and Wildlife Service, the Greater Flagstaff Forest Partnership, Friends of the Rio de Flag, Arizona Snowbowl, and many others. We anticipate continued discussion and input from these and other interested parties, including potential opportunities for research, monitoring, and cooperative management efforts.

Using the comments received during the scoping period (see *Issues* section), the interdisciplinary team developed a list of issues to address.

Issues

The Forest Service separated the issues into two groups: key issues and other issues. Key issues were defined as those directly or indirectly caused by implementing the proposed action. Other issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council for Environmental Quality (CEQ) NEPA regulations require this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…" A list of other issues and reasons regarding their categorization may be found in the project record.

Based on the scope of the project, the following issues were identified for further analysis:

Roads: The roads proposed to be closed and approximate locations of temporary roads needed for treatment are identified in the Proposed Action (Chapter 2). Actions required to close and/or decommission roads are included in the Proposed Action (Chapter 2). Impacts to soil and watershed resources from temporary road construction and road obliteration/decommissioning are discussed under the Soil and Watershed sections in Chapter 3.

Silviculture: Portions of the Large Tree Retention Strategy[2] (brought forth in a scoping comment) not already covered under the Wing Mountain purpose and need were incorporated into the proposed action design features, and the wide-spread application of a 16 inch dbh cap was analyzed in an additional alternative in Chapter 2 (Alternative 3: Proposed Action with 16 inch dbh cap with exceptions described in the Large Tree Retention Strategy (LTRS)).

[2] The Large Tree Retention Strategy is an agreement forged under the Four Forests Restoration Initiative (4FRI) project for retaining large diameter trees and identifying situations where large trees may be removed to faciliate forest health and attainment of old growth characteristics.

Old Growth: All stands exhibiting old growth characteristics were identified and are discussed in the "Vegetation and Forest Health" section of Chapter 3. The Silviculture Specialist Report provides details of the survey methods used for the project.

Fire and Fuels: The effects of prescribed burning on tree survival are discussed under the Fire and Fuels section in Chapter 3, and in the Fire and Fuels Specialist Report in the project record.

Wildlife: Impacts to northern leopard frogs, northern goshawk, and other Threatened, Endangered and Sensitive species and their potential habitat are included in the Wildlife section of Chapter 3 (under FS sensitive species).

Watershed: Spring restoration activities are discussed in the Watershed section of Chapter 3, including restoration methodology and monitoring.

Scenic Resources: Both short and long term effects to scenic resources are discussed in the Recreation and Scenery Management section of Chapter 3.

Chapter 2 – Alternatives

This chapter describes and compares the alternatives considered for the Wing Mountain Fuels Reduction and Forest Health Restoration project. It includes a description and map of each alternative considered, including design features associated with the proposed action. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public.

Alternative 1 – No Action

Under the No Action alternative, current management plans would continue to guide management of the project area. No thinning, burning, spring restoration or road management would be implemented to accomplish project goals in the foreseeable future.

Alternative 2 – The Proposed Action

Ponderosa Pine Restoration – 7079 acres

- Utilize uneven-aged management methods to promote regeneration and a more uneven-aged forest structure.
- Emphasize retaining old, pre-settlement trees.
- Desired leave tree arrangement would be "clumpy-groupy".
- Tree groups would vary in shape, size, density, and number (approximately 2-40 trees per group, up to 0.7 acres in size, basal area of 50 ft^2 per acre or greater in VSS 4-6).
- Stands and areas within stands with moderate or high levels of Dwarf Mistletoe infection would be treated with an intermediate thinning. Tree groups would average 70 to 90 square feet of basal area. Retain the healthiest and largest trees with the least amount of mistletoe.
- Pile and broadcast burning (initial entry and maintenance).

Ponderosa Pine Restoration within Northern Goshawk Post-Fledging Family Areas – 959 acres

- Utilize uneven-aged management methods to promote regeneration and a more uneven-aged forest structure.
- Emphasize retaining old, pre-settlement trees.
- Desired leave tree arrangement would be "clumpy-groupy".
- Tree groups would vary in shape, size, density, and number (approximately 2-40 trees per group, up to 0.7 acres in size, basal area of 70 ft^2 per acre or greater in VSS 4-6).
- Stands and areas within stands with moderate or high levels of Dwarf Mistletoe infection would be treated with an intermediate thinning and prescribed burning per management recommendations of Conklin and Fairweather (2010). The healthiest and largest trees with the least amount of mistletoe would be retained. Tree groups would average 70 to 90 square feet of basal area.
- Pile and broadcast burning (initial entry and maintenance).

Ponderosa Pine Restoration within Northern Goshawk Nest Areas – 456 acres

- Manage for mature to old age forest with high canopy cover.

- Utilize thinning from below to promote the desired stand structure.
- Emphasize retaining old, pre-settlement trees.
- Utilize non-uniform spacing
- Manage for basal area of 70+ ft^2 per acre or greater in VSS 5-6.
- Pile and broadcast burning (initial entry and maintenance).

Mixed Conifer Restoration – 9 acres

- Utilize uneven-aged management methods to promote regeneration and a more uneven-aged forest structure.
- The current proportional mix of mature species would be maintained after treatment.
- Emphasize retaining old, pre-settlement trees. No trees over 24" dbh would be cut in MSO restricted habitat.
- Desired leave tree arrangement would be "clumpy-groupy".
- Tree groups would vary in shape, size, density, and number (approximately 2-40 trees per group, up to 0.7 acres in size, basal area of 70 ft^2 per acre or greater in VSS 4-6).
- Stands and areas within stands with moderate or high levels of Dwarf Mistletoe infection will be treated with an intermediate thinning. Tree groups would average 70 to 90 square feet of basal area. Retain the healthiest and largest trees with the least amount of mistletoe.
- Pile and broadcast burning (initial entry and maintenance).

Mexican Spotted Owl Restricted Target Threshold – 82 acres

- Manage for Mexican spotted owl (MSO) target threshold conditions for mixed conifer.
- Emphasize retaining large trees.
- Thin from below to reduce fuel ladders and loading**.**
- Maintain or manage for basal area of 150 and 170 ft^2.
- Pile and broadcast burning (initial entry and maintenance).

Mexican Spotted Owl Protected Activity Center (PAC) Treatment – 392 acres

- Thin from below to reduce ladder fuels and fuel loading.
- Treatment methods include mechanical and hand thinning in areas with steep slopes (40% or greater) and inoperable terrain.
- Treatment would be limited to thinning trees less than 9 inches diameter breast height (dbh).
- Pile and broadcast burning (initial entry and maintenance).

Meadow Restoration - 619 acres

- Removal of conifer encroachment using hand thinning or mechanical treatment followed by prescribed fire. Hand thinning would be used to remove trees less than 5 inches dbh which would not be included in a timber sale contract.
- Stimulate growth and regeneration of herbaceous species using prescribed fire; pile and broadcast burning (initial entry and maintenance).

Grassland with Pine Savannah Restoration–173 acres

- Remove mixed conifer species and excess ponderosa pine.
- Restore former grassland conditions, leaving 5-15 trees per acre based on number of pre-settlement evidences on the ground.
- Pile and broadcast burning (initial entry and maintenance).

Fuels Reduction Thin from Below—325 acres

- Thin from below to reduce ladder fuels and fuel loading
- Treatment areas include MSO restricted habitat (approximately 212 acres), Northern Goshawk nest areas (approximately 60 acres), areas with slopes with sensitive soils, and inoperable boulder fields.
- Treatment methods include mechanical and hand thinning;
- For those acres inside MSO restricted habitat, treatments would follow Forest Plan and MSO Recovery Plan guidelines.
- Where feasible, canopy gaps would be created between tree groups, typically not more than 50 feet.
- Basal area would typically be 70 BA or greater across the stand.
- Pile and broadcast burning (initial entry and maintenance).

Aspen Restoration— 272 acres

- Approximately 272 acres are designated as pure aspen cover type within the project area.
- A variety of different treatments would be used to promote aspen health and regeneration, including the removal of conifer encroachment, prescribed fire, ripping, planting, and/or cutting of aspen to induce root suckering. Methods to protect aspen regeneration from severe ungulate browsing could include jack-strawing and fencing (see the Vegetation and Forest Health section of Chapter 3 for more information on jackstrawing methods and potential locations).
- Aspen stands which would receive priority consideration for fencing include those stands which are lower in elevation, isolated patches, in danger of being lost in the near future, and located in areas with a desired scenic integrity objective of high (see Figure 5 in Chapter 3).
- There is an additional 1046 acres of mixed conifer and ponderosa pine stands which contain small groups of aspen scattered throughout those stands. Those small groups would also receive aspen restoration treatment in addition to the main proposed treatment for that area. In areas where those aspen groups occur within Mexican spotted owl PACs (approximately 25 acres), aspen regeneration treatment would follow those treatments described under MSO PACs (see Design Features).
- No aspen restoration treatments are proposed within MSO PAC nest stands.

Burn only - 577 acres

- Prescribed fire would be the only treatment in the burn scars from the Pipe and Whitehorse fires, in the old experimental clearcut, and on Wing Mountain itself.
- 131 acres are designated MSO protected.
- Broadcast burning (initial entry and maintenance).

No Treatment – 200 acres

- Includes old borrow material pits, the Transwestern gas pipeline right of way, and sensitive MSO habitat. Additionally, approximately 18 acres of private property occur within the project boundary; these acres would also not be treated.

Spring Restoration

Restoration of Maxwell and Big Leroux Springs would be an initially passive approach relying on volunteers and Forest Service staff as available. Passive restoration efforts focus on reducing or eliminating the sources of degradation and allowing recovery time.

- Maxwell Spring: passive restoration would potentially include modifications to the existing spring well to allow additional spring water to emerge at the surface in order to restore riparian and aquatic habitat.
- Big Leroux Spring: passive restoration would potentially include removal of the existing aboveground concrete tank downhill of the spring, removal of the existing barbed wire fence surrounding the spring, installation of piezometers to monitor soil moisture conditions, and adjustment of the existing diversion valves to allow a portion of the spring flow to discharge to its historic location. The existing spring box and valve box would remain in place as would the underground piping conveying spring water to the hotshot headquarters. Unauthorized adjustments to the position of the valves would be prevented by maintaining the current locked spring and valve box covers. Both valves would be placed in their fully open position, which would allow roughly 44% of spring discharge to "daylight" at its historic location.

If after several years, monitoring suggests that passive restoration is not enough to improve native flora and fauna diversity, planting of riparian vegetation, installation of ungulate exclosure fencing, and/or limited modification of the spring discharge channel (i.e., construction of pools and other stream features to improve habitat using hand labor) would be initiated. Monitoring by volunteers and/or Forest Service staff would potentially include but not be limited to repeat photo-monitoring, semi-annual flora and fauna surveys, soil moisture monitoring through installation of piezometers, and mapping of surface hydrologic features as they develop. Installation of shallow temperature sensors would potentially also be used to track the downstream extent of surface water

Temporary Roads and Improvements

There is a large network of existing roads within the project area. Existing roads would be used to the extent possible for hauling harvested trees. Forest Roads (FR) 9216M, 164C, 222, and 171 would be used as main haul routes. FR 519 would be reconditioned, including all drainages, and resurfaced from FR 222 to FR 518 using material from Riordan Pit. FR9232R would also be reconditioned. Snowbowl Road (FR516) may be used as a haul route; however no log truck traffic would be allowed when Snowbowl Ski Resort is open for ski season or during permitted special use events using Snowbowl Road. The construction of approximately 3.25 miles of temporary roads is anticipated in order to facilitate tree harvesting operations and hauling (Figure 2). The precise location of temporary roads cannot be determined until a contract for the treatment is secured and the type of equipment to be used by the contractor is determined. These roads would not be added to the forest transportation system and would be rehabilitated after project completion.

Road Decommissioning and Closures

With the implementation of TMR, approximately 48.88 miles of road are proposed for decommission, and approximately 5 miles are planned for obliteration (see descriptions of the treatments below). The 48.88 miles of roads to be decommissioned would be accomplished within the scope of a Timber Sale Contract or Stewardship Contract.

Forest Road 151A would be used as a haul route during operations. Following completion of project implementation, a segment of FR151A would be decommissioned between Highway 180 and FR9216M.

Road decommissioning and temporary road rehabilitation would vary based on the conditions of the existing road. Slash could be used to cover the road, block motorized use, and to facilitate vegetation regeneration. In other cases, re-vegetation might not occur naturally due to compacted soils. In this case, mechanized equipment may be used to scarify the existing road bed to block motorized travel and prepare a seed bed so that native seed could be used to re-vegetate the area.

Decommissioning would follow these three steps:

- Removal of any posted road designators (road numbers, names)
- Changing the status in the FS database used to track roads
- Blocking the road entrance or obliteration of the road bed to some degree to discourage unauthorized motor vehicle access

Obliteration would consist of any or all of the following:

- Ripping the road bed for a distance visible from the junction with an existing road (no more than 200-250 yards, generally less than 100 yds.)
- Rolling any significant windrows back into the road bed along its entire length
- Installing/maintaining adequate drainage structures (ie. rolling dips, water bars, cross ripping, outsloping)
- Seeding with native seed species the entire length
- Scattering slash randomly along the road, heavily along the ripped portion

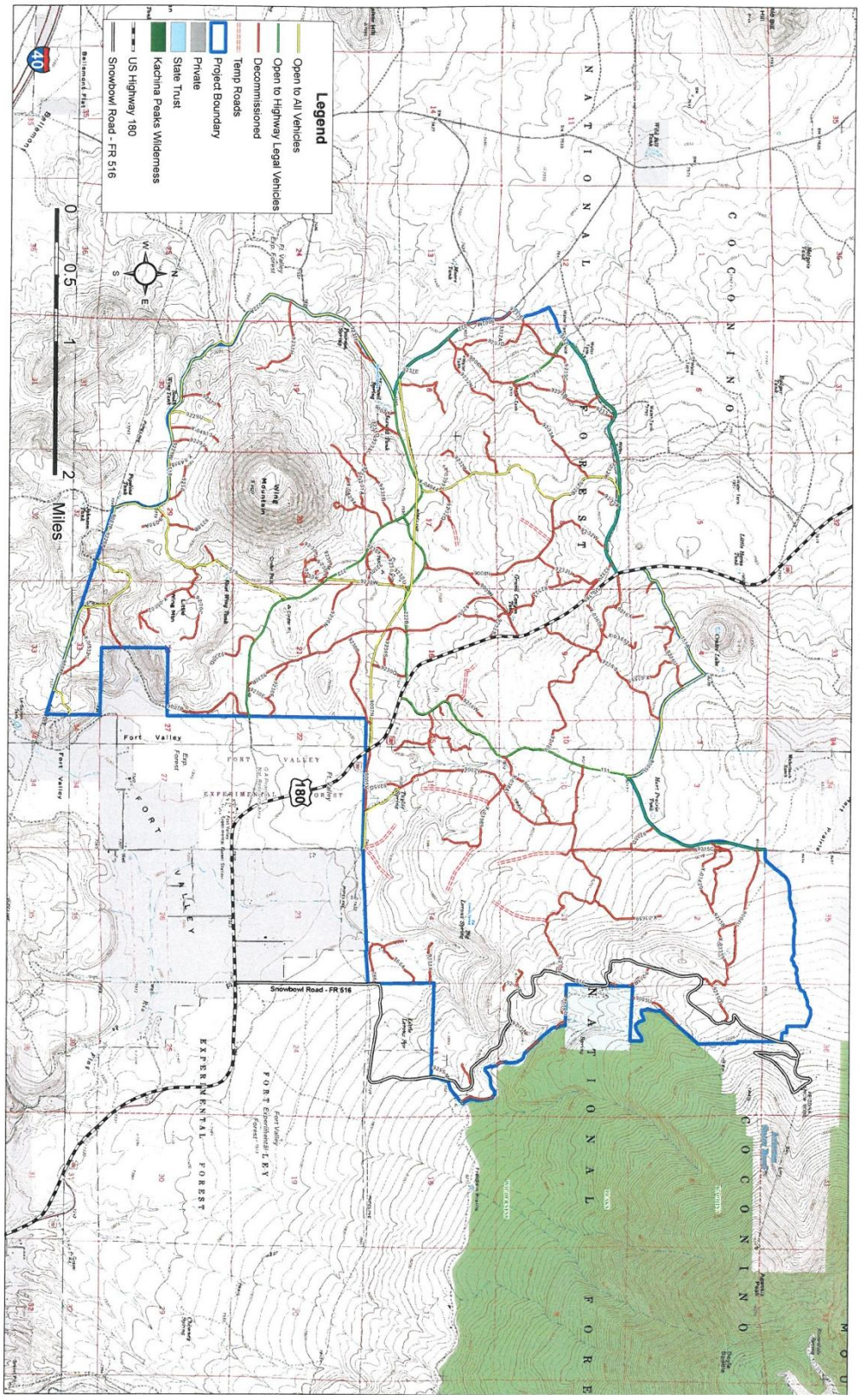


Figure 2: Proposed road system, including potential temporary road locations

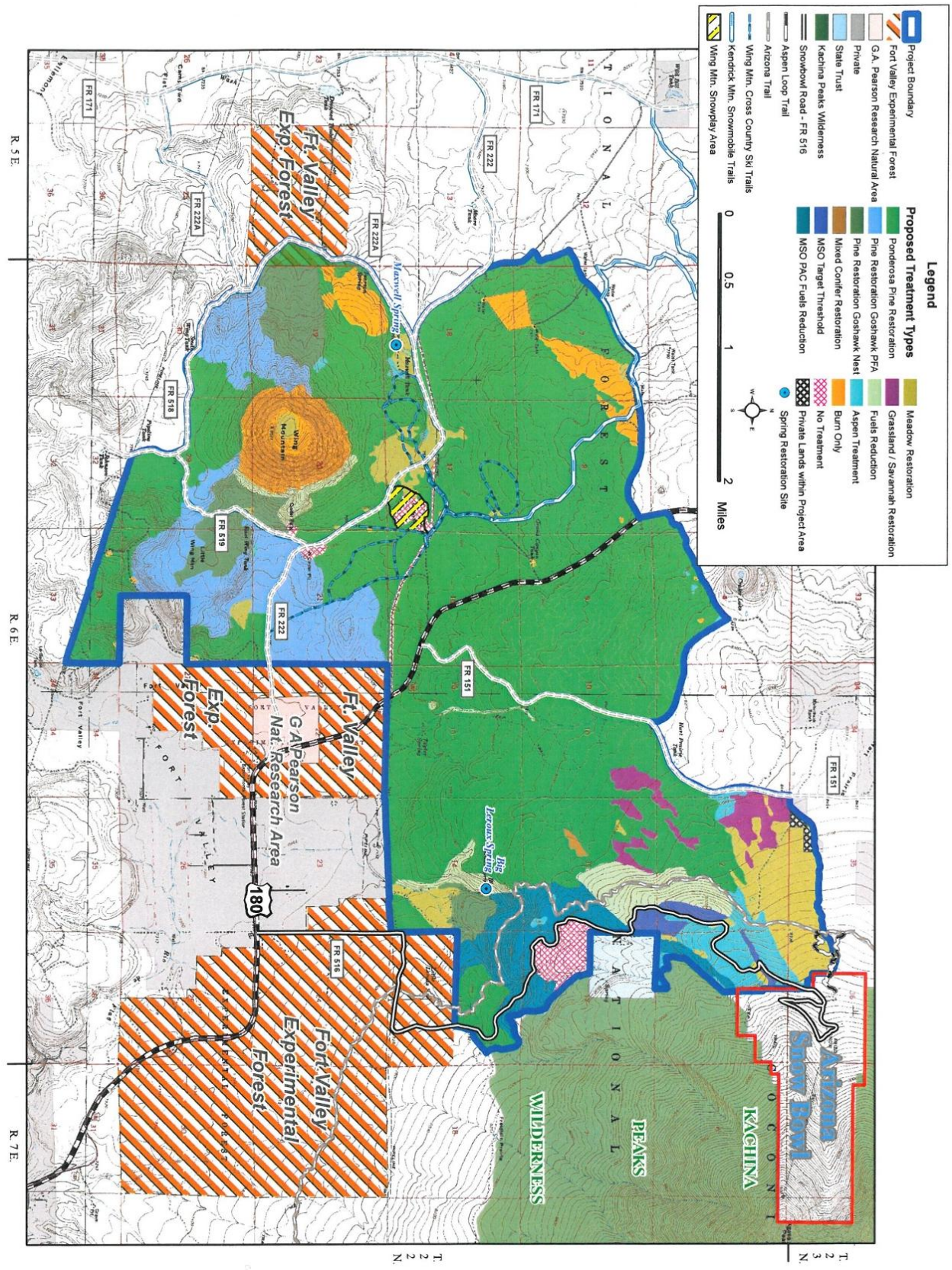


Figure 3: Proposed Action Treatments

Coconino National Forest Management Plan Amendments

One non-significant Forest Plan amendment is anticipated for this proposed action.

Amendment Description: In the "Vegetation Management - Landscapes Outside Goshawk Post-fledgling Family Area's" and "Vegetation Management -Within Post-fledgling Family Areas" section of the Forest Plan, a non-significant plan amendment would: (1) remove and/or replace references to using vertical crown projection to measure canopy cover with language specific to this analysis, (2) add the desired percentage of interspace within uneven-aged stands to facilitate restoration and define interspace, (3) add the interspace distance between tree groups, (4) add language clarifying where canopy cover is and is not measured, (5) provide minimum stocking guidelines to inform canopy cover at the group level and, (6) add language clarifying reserve trees are specific to created regeneration openings in Landscapes Outside Goshawk Post-fledgling Family Areas. Appendix C contains more information on the proposed Forest Plan amendment, including the new or edited text.

Definition of Treatment Terms

Groupy- Refers to the desired leave tree arrangement, i.e., groups of trees of varying size, shape, VSS, and density, separated by grassy interspaces and interspersed among regeneration openings. Groups may be even-aged or uneven-aged, depending on the existing forest structure. A groupy leave tree arrangement results in increased horizontal heterogeneity.

Pre-Settlement- Prior to the disruption of the natural frequent fire regime and widespread Euro-American settlement of the area, generally accepted as the 1870s.

Northern Goshawk Foraging Habitat-Refers to all ponderosa pine stands outside of northern goshawk post fledgling areas (PFA) and outside of all Mexican spotted owl habitat.

*Interspace***:** The space between groups and clumps of trees (VSS 1-6) that are intended to be dominated by grass/forb/shrub vegetation and may include scattered individual trees (see Appendix C for more information).

Design Features and Mitigation Measures

Applicable Forest Plan standards and guidelines, Best Management Practices, and Forest Service Manual and Handbook direction would be incorporated in project design and implementation. The following features are design elements that further detail management actions, and mitigate environmental consequences.

Table 5 Design Features Associated with Alternative 2: Proposed Action

Specialist Area	Related Resource	Mitigation Measure
Silviculture	Old Trees	Old trees, as defined by Thomson, 1940, would not be targeted for cutting. However, exceptions may be necessary. An example of this would be to cut an old tree in order to accommodate the turning radius of a logging truck, rather than

Specialist Area	Related Resource	Mitigation Measure
		relocating an entire road. Another exception would be removing an old tree to address human health and safety concerns.
	Large Trees	Post-settlement ponderosa pine trees > 16 inches dbh may be removed to restore forest health and to emulate natural vegetation patterns based on current stand conditions, pre-settlement evidences, desired future conditions, or other restoration objectives. Instances where this would occur include: in conifer-encroached aspen stands, encroached grasslands, and in heavily stocked stands of large, young trees when the presence of such trees would prevent the re-establishment of sufficient stand openings. Removing such trees would only occur when these actions do not conflict with existing recovery/conservation plan objective for managing sensitive, threatened, or endangered species or their habitat. Within MSO restricted habitat, trees greater than 24 inches dbh would not be harvested.
	Aspen Restoration	• Jackstrawing may occur in appropriate locations as identified by the IDT within the Wing Mountain project area once the effectiveness of the same activity applied within the Hart Prairie Fuels Reduction and Forest Health Project is determined. • Jackstrawing would not be utilized in areas closest to the urban interface or where the prevailing wind could adversely affect the design of the treatment if a fire were to occur. • No jackstrawing would occur within MSO PACs. • In aspen stands located within MSO PACs, treatments identified for the PACs would extend across those aspen stands, including thinning up to 9" dbh in the mixed conifer and prescribed burning. If additional methods for aspen protection are determined to be necessary, fences would be made of sucker rod and constructed outside the breeding season to avoid impacts to MSOs.
Heritage	Site Protection	• All fire intolerant sites would be marked for

Specialist Area	Related Resource	Mitigation Measure
		avoidance from prescribed burning and all sites protected from ground disturbing activities. In the event a historic or pre-historic cultural resource is found during implementation of the Proposed Action, all activities would cease and appropriate officials and affiliated tribes would be notified to evaluate the situation. • Areas where temporary roads would be constructed would be inventoried prior to implementation. • Archaeological monitoring, public education, and law enforcement patrols will help to mitigate increased vandalism resulting from increased visibility in areas within the project area that have experienced ground cover loss after fuels treatment.
Wildlife	Mexican Spotted Owl	• MSO surveys would be coordinated with the Fish and Wildlife Service the year of implementation or one year prior to determine occupancy of owls. • The Forest Service would monitor effects to MSO from the proposed action and report their findings to the FWS. Implementation monitoring shall include information such as when or if the project was implemented, whether the project was implemented as analyzed in the site specific BO (including conservation measures, and best management practices), breeding season(s) over which the project occurred, relevant MSO survey information, and any other pertinent information about the project's effects on the species. • No thinning, prescribed burning, temporary road construction, maintenance or obliteration would occur within occupied PACs during the breeding season (March 1 to August 31). Project activities within 0.25 mile of occupied PACs would also be avoided during the MSO breeding season. • No project activities would occur within 0.5 mile of active nests. • Coordinate burning spatially and temporally to limit smoke impacts to nesting owls,

Specialist Area	Related Resource	Mitigation Measure
		particularly for PACs with nests in draws & canyons (effective March 1 to August 31). • Thinning in PACs would focus on reducing fire risk while maintaining a multi-storied canopy where possible. • Trees greater than 24 inches dbh would not be harvested in restricted or protected habitat.
	Northern Goshawk	• Harvest activities would not occur in occupied PFAs during the breeding season (March 1 to September 30). • Spring restoration projects (Big Leroux) would not occur in the Viet Springs PFAs during the breeding season (March 1 to September 30) if occupied. • Prescribed burn plans in northern goshawk PFAs would be designed and implemented to minimize smoke impacts to nesting birds and minimize loss of nest trees.
	Turkey	• Prep roost trees as needed prior to broadcast burning and target "cool" burns. • Leave at least 9 scattered patches of slash, post-treatment, distributed within each section (640 acres) of the analysis area if possible.
	Deer	Defer treatments on the steep slopes along the eastern boundary of the project area near Snowbowl Road and on the slopes of Wing Mountain between May 15 and August 31.
	Pronghorn	Avoid thinning and burning within known travelways during the first major snowfall of a given year to allow for seasonal migration.
	Bats	A 300-foot no thinning buffer would be designated around cave entrances, sink hole rims, and drainages leading to these features to protect cave ecosystems (including microclimate, hydrology, and entrance vegetation) and reduce potential disturbance to roosting bats.
	Other Raptors	Raptor nests located during project surveys would be monitored prior to project activities. The following buffers would be provided if nests are active: Cooper's hawk = no mechanical treatment buffer of 15 acres around occupied nests

Specialist Area	Related Resource	Mitigation Measure
		Sharp-shinned hawk = no mechanical treatment buffer of 10 acres around occupied nests Other raptors = 50 ft around mechanical treatments around occupied nest
	Black-footed Ferrets (prairie dog towns)	Prairie dog surveys would be completed in documented prairie dog towns within treatment areas to determine if towns are active. If active towns form a large enough complex to support ferrets, black-footed ferret surveys would be completed prior to implementation within prairie dog towns. Fire is encouraged following surveys.
	Snags	• Protect snags and logs wherever possible through site prep, implementation planning, and ignition techniques to retain ≥ 2 snags per acre ≥12" dbh and ≥15 ft in height and ≥3 logs with ≥12" mid-point diameter and ≥ 8 ft in length. • Retain ≥ 2 trees per acre ≥18" dbh with dead tops, cavities, and lightning strikes wherever possible to provide cavity nesting/foraging habitat. • Emphasize retention of snags exhibiting loose bark to provide habitat for roosting bats.
	Dependable Waters	Maintain hiding cover at least 200 feet around dependable waters (trick tanks).
Botany	Noxious/Invasive Weeds	Best Management Practices as outline in Appendix B of the "Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds" (USDA Forest Service 2005) would be followed to incorporate weed prevention and control into the project. The following features would be incorporated into project implementation and monitoring: • Treat weed infestations within stands before implementing treatments to be conducted by Flagstaff Ranger District personnel. • Wash vehicles and equipment prior to entering the project area, when moving from one area to another within the project area, and when leaving project area. • Place slash piles on previously used locations such as old piling sites, old log deck sites, or other disturbed sites to avoid severe

Specialist Area	Related Resource	Mitigation Measure
		disturbance to additional locations where possible. • Monitor slash pile sites after burning and control noxious or invasive weeds. • Manage prescribed fires as an aid to control existing weed infestations and to prevent the spread of existing weeds. • Avoid existing noxious or invasive weeds during soil disturbing activities associated with rehabilitation of decommissioned roads where possible.
	Sensitive Plants	• Prohibit slash pile construction within populations of Rusby's milkvetch; construct slash piles at least 10 to 20 feet away from populations of Rusby's milkvetch. • Prohibit temporary road construction or reconstruction within populations of Rusby's milkvetch. • Utilize existing disturbed areas, where possible, when creating slash piles. These areas include but are not limited to previously used sites for slash piling and log decking areas.
Soil/Watershed	BMP #1	On areas to be prescribed burned, fire prescriptions should be designed to minimize soil temperatures over the entire area. High intensity fire should occur on 10% or less of the entire area. Fire prescriptions should be designed so that soil and fuel moisture temperatures are such that fire intensity is minimized and soil health and productivity are maintained.
	BMP #2	Conduct prescribed burning in ponderosa pine vegetation type so as to retain 5-7 tons/acre of coarse woody debris buffers around private land inholdings of ¼ mile do not have a minimum coarse woody debris requirement.
	BMP #3	On areas to be prescribed burned, establish filter strips averaging 1 chain (66 feet) buffer on each side of riparian streamcourses and an average of ½ chain (33 feet) buffer on each side of non-riparian streamcourses to filter sediments that would occur from the burn. Do not ignite fuels within this buffer area. Some

Specialist Area	Related Resource	Mitigation Measure
		creep may occur into the buffer.
	BMP #4	On areas to be prescribed burned or pile burned, if containment lines are put in place, rehabilitate lines after use by either rolling berm back over the entire fireline, or waterbar fireline. If line is only to be waterbarred, disguise the first 400 feet of line to discourage use as a trail.
	BMP #5	Do not blade roads when the road surface is too dry. If the road surface is too dry, a water truck can apply water, or the project can be scheduled for when adequate moisture occurs to complete the project.
	BMP #6	All fueling of vehicles would be done on a designated upland site. If the total oil or oil products storage exceeds 1,320 gallons in containers of 55 gallons or greater, Purchaser shall prepare a Spill Prevention Control and Countermeasures Plan. Such plan shall meet applicable EPA requirements, including certification by a registered professional engineer as per 40 CFR 112.
	BMP #7	If construction crews were to live on-site, then an approved camp and suitable sanitation facilities would be provided.
	BMP #8	Designated skid trails and log landings would be required by Timber Sale Contract (TSC) (see TSC provisions **BT6.422, CT6.4# and BMP 24.18**) on all cutting units. Skid trail design should not include long, straight skid trails that would direct water flow. Skid trails should also be located out of filter strips (exceptions are at approved crossings).
	BMP #9	Felling to the lead would be required within the Timber Sale Contract (TSC) to minimize ground disturbance from skidding operations (**CT6.4# and BMP 24.18**).
	BMP #10	The TSC outlines the timing and application of erosion control methods (see TSC provisions **BT6.31, BT6.6, BT6.63, BT6.64, BT6.65, CT6.6, CT6.601#, and CT6.602)** to minimize soil loss and sedimentation of streamcourses. Seed mix can include any of the following certified weed free native species at a minimum of 5 lbs/acre pure

Specialist Area	Related Resource	Mitigation Measure
		live seed: Arizona fescue (Festuca arizonica) Screwleaf muhly (Muhlenbergia virescens) Western wheatgrass (Elymus smithii) Mountain muhly (Muhlenbergia Montana) Purple geranium (Geranium caespitosum) Western yarrow (Achillea millefollium) Pussytoes (Antennaria marginata) Arizona peavine (Lathyrus arizonicus) Fringed sagebrush (Artemisia frigida) The seed mix can contain a mixture of these suggested species, but should not contain all of these species and should include at least 1 grass species. The seed mix depends on the availability of these species. Corresponding BMPs to minimize soil loss include **24.13, 24.21, 24.22, 24.23, 24.24, and 24.25**. The preferred erosion control on the skid trails in the harvest areas would be by spreading slash. Other acceptable erosion control measures include, but are not limited to, waterbarring (waterbars should not be more than two feet deep and need at least a ten foot leadout. Waterbars are only to be implemented with equipment with an articulating blade (no skidders) or by hand.), removing berms, seeding, mulching and cross-ripping. Erosion control after skidding operations must be timely to minimize the effects of log skidding.
	BMP #11	Road drainage is controlled by a variety of methods (**BMP 41.14**), including rolling the grade, insloping outsloping, crowning, water spreading ditches, and contour trenching. Sediment transport at drainage structures can be reduced by installing sediment filters, rock and vegetative energy dissipaters, and settling ponds. Design of roads is included in the transportation plan of the Timber Sale Contract, Table 1, and T-specs.
	BMP #12	Road maintenance (**BMP 41.25 and BT5.4)** through the **TSC** should require prehaul and post haul maintenance on all roads to be used for haul.
	BMP #13	The designation of filter strips minimizes the

Specialist Area	Related Resource	Mitigation Measure
		movement of sediment from timber harvest areas to streamcourses (**BMP 24.16**). Locations of protected streamcourses are included in the **Sale Area Map (SAM)** (**BT6.5**). Dimensions of streamcourse filter strips are as follows: Riparian streamcourse: 1 chain (66 feet) on each side of streamcourse. Non-riparian streamcourse: 1/2 chain (33 feet) on each side of streamcourse. Accepted harvest activities within riparian and non-riparian filter strips include limited skidding and mechanized tree felling. Landings, decking areas, machine piles, skid trails, and roads (except at designated crossings) are planned outside of riparian and non-riparian filter strips.
	BMP #14	Do not operate equipment when ground conditions are such that soil compaction can occur.
	BMP #15	No mechanical harvest or mechanical fuel treatment allowed on Cinder Cones greater than 25% slope. On other sites, mechanized harvesting can occur up to 40% slopes.
	BMP #16	Planned ignitions on Cinder Cones greater than 25% slope and on other areas greater than 40% slope fire prescriptions should be designed so that soil and fuel moisture temperatures are such that fire intensity is minimized and soil health and productivity are maintained.
Recreation & Scenery Management	On Edges of Individual Units	Edges of treatment units would be shaped as described below to avoid abrupt changes between treated and untreated areas. Edges would be natural-appearing, feathered, and would blend with general surroundings. Feathering refers to softening treatment edges by thinning in the following manner: • Where the treatment unit is adjacent to denser forest (treated or untreated), the percent of thinning within the transition zone would be progressively reduced toward the denser edges of the unit. Similarly, where the treatment unit interfaces with an opening (including savannah and grassland treatments, and natural openings) the transition zone would

Specialist Area	Related Resource	Mitigation Measure
		be progressively increased toward the open edges of the unit. • Treatment would extend up to the edges and does not leave a screen of trees. Groups of trees complying with the prescribed treatment would be left that visually connect with the unit's edge, to avoid an abrupt and noticeable change.
	Unit Marking	Mark trees that are to be removed on the backs of trunks, away from the primary viewing point (i.e. from roads and trails).
	Road, Skid Trail and Landing Construction	1. Minimize and avoid the placement of log decks, temporary roads, and skid trails within and adjacent to sensitive viewsheds, Concern Level 1 travelways, developed recreation sites, and private homes/communities. Concern Level 1/High Sensitivity Level travelways include Highway 180, FR516 (Snowbowl Road), FR151 (Hart Prairie), FR222A, FR222B, FR222, FR519, and FR522. Concern Level 1 trails include the Arizona Trail, Aspen Loop Trail, the Kendrick Snowmobile and Cross Country Ski Trails. a) The decks must be reseeded and mulched according to applicable BMPs (see Soil and Water Specialist Report) as soon as possible to speed recovery, with high priority along Concern Level 1 travelways, trails, and developed recreation sites. 2. Avoid using National Historic, Recreation or other specially designated trails for temporary roads or skid trails (i.e. Arizona Trail). a) Temporary road construction and skid trail crossings may cross designated trails, but would be kept to a minimum. Any crossings would be perpendicular to the designated system trail. b) If trails are used as skid trails/temporary roads, trail clean up and rehabilitation would be included in the contract. This should include

Specialist Area	Related Resource	Mitigation Measure
		restoring the trail to its original trail width. c) Changes to trail alignment and surfacing would be minimized; the trail would not be straightened nor its surface changed with an alternate material unless such actions are approved by the District Recreation Staff and are needed to enhance the trail and protect resources.
	Cull Logs, Stump Heights, and Slash Treatments	• Cull logs would not be abandoned on landings. a) Cull logs could be used for closing temporary roads and decommissioning roads. b) Cull logs may also be suitable to use as down woody material, but must be scattered away from the landings. • Stump heights should be cut as low as possible within the foreground (300 feet from centerline of roads, trails, or edge of recreation sites) of Concern Level 1 roads and trails, with the cut angled away from the viewer in these areas. • Locate slash piles and landings 300 feet from edge of high sensitivity roads and trails where possible. Where slash occurs within the 300-foot immediate foreground of Concern Level 1 roads and trails, treat slash as soon as possible, within one year, to bring the Scenic Integrity Objectives back to prescribed levels after project implementation.
	Fire Control Lines	Generally restore control lines to a near undisturbed condition in the foregrounds (within 300 feet) of sensitive roads, trails, and developed recreation sites. 1. To hasten recovery and help eliminate unauthorized motorized and non-motorized use of control lines in these areas, use measures such as recontouring, pulling slash and rocks across the line, and disguising

Specialist Area	Related Resource	Mitigation Measure
		entrances. 2. Where trails are used, rehabilitate trails to original width, condition, and designated class level.
	Recreation & Other Trail Mitigation	• Avoid using trails as treatment unit boundaries especially for mechanical treatments for Concern Level 1 trails: Arizona Trail, Aspen Loop Trail, the Kendrick Snowmobile and Cross Country Ski Trails. • Provide public notice and information about treatment locations, timing and the type of treatment occurring prior to and during vegetation and fire treatments.
	Aspen Treatments & Spring Restoration	• Jackstrawing would not occur in the foreground (300 feet from centerline of roads, trails, or edge of recreation sites and private land/communities) or viewshed of Highway 180, FR516 (Snowbowl Road), FR151 (Hart Prairie), FR222A, FR222B, FR222, FR519, and FR522. Concern Level 1 trails include the Arizona Trail, Aspen Loop Trail, the Kendrick Snowmobile and Cross Country Ski Trails. • Jackstrawing should not occur in the 300-foot immediate foreground of Concern Level 2 immediate foregrounds: 164 C, 151A. If jackstrawing is used, minimize the amount of jackstrawing immediately adjacent to the roadsides. Work with Landscape Architect during project implementation to identify the viewshed boundary within which jackstrawing should not occur. • If spring restoration or aspen fencing would be visible from any Concern Level 1 roads, developed recreation sites and trails, work with Landscape Architect during project implementation to determine fencing materials to mitigate potential impacts to scenery and minimize visual impacts. Work with Landscape Architect during project implementation to ensure stability of scenic quality.
Fire & Fuels	Prescribed Burning Implementation	• Fire-resilient landscape features would be utilized in the formation of burn plans as a typical practice. Specific landscape features

Specialist Area	Related Resource	Mitigation Measure
		of this nature are too numerous to map spatially for the project and could change between analysis and the time of implementation (i.e. due to wildfire, drought, etc.) and so will not be included in the EA. Anchor points and burn patterns would be determined based on the topography and fuels at each site, as well as the weather at the time of implementation. • Design prescribed burns to cover large areas and be of short duration (2 to 7 days). Burning would occur when weather and other prescription criteria are met. • Burning would be planned for times when weather and other environmental factors such as wind, fuel moisture and humidity are most suitable (primarily during the fall and early spring). • Any prescribed burn would be approved in advance by the Arizona Department of Environmental Quality to ensure air quality standards are maintained. Public notification of burning would take place prior to the ignition of any prescribed fire.
	Right of Way (ROW) Thinning	• Thinning would extend into the Highway 180 ROW. Encroachment permit from ADOT would be obtained prior to implementation. Slash piles and log decks would be placed outside of the recovery zone (30 feet). ROW fencing would be fixed in a timely manner when impacted by project activities. • Project-generated slash would be placed outside of permitted utility line and pipeline rights-of-way. Slash pile placement would not interfere with utility corridor management.
Range	Grazing	• Protection measures would be implemented to ensure range structural improvements are not impacted during prescribed burning or timber harvest operations. If structural improvements are damaged, they will be repaired/replaced by the appropriate resource. • Implementation personnel including fuels/fire and timber would coordinate

Specialist Area	Related Resource	Mitigation Measure
		prescribed burning and timber harvest activities with livestock management when scheduling implementation activities. This includes the scheduling of prescribed burning and number of acres to be burned within individual pastures, as well as timber harvesting locations on an annual basis. • Permanent vegetation monitoring transects would be documented with location points taken by GPS and monument markers prior to implementation; treatments would occur within the plot, followed by reestablishment of transect markers.

Alternatives Considered but Eliminated from Further Analysis

Based on a public comment regarding the incorporation of a Large Tree Retention Strategy (LTRS), the ID Team analyzed an additional alternative, discussed below. Portions of that strategy were incorporated as design features in the proposed action (see Silviculture section in Table 5), and the following alternative was developed to analyze the effects of a 16 inch dbh restriction (with the listed exceptions found in the LTRS). This alternative was determined to not meet the purpose and need of the project or to be technically infeasible; therefore, it was eliminated from further analysis in the EA.

Alternative 3: *Proposed Action with 16 inch dbh cap with exceptions described in the Large Tree Retention Strategy* (LTRS)

This alternative would restrict the cutting of all trees larger than 16 inches dbh throughout the project area except for those areas identified as "exceptions" in the LTRS (see project record). The following analysis details the places where the "exceptions" would apply, which equals roughly 90% of the project area. In addition, the effects of a wide-spread application of a 16 inch dbh cap across the project area were analyzed to show how such a cap would inhibit treatment effectiveness and thus the ability of the project to meet its purpose and need. The project record contains more information on this analysis.

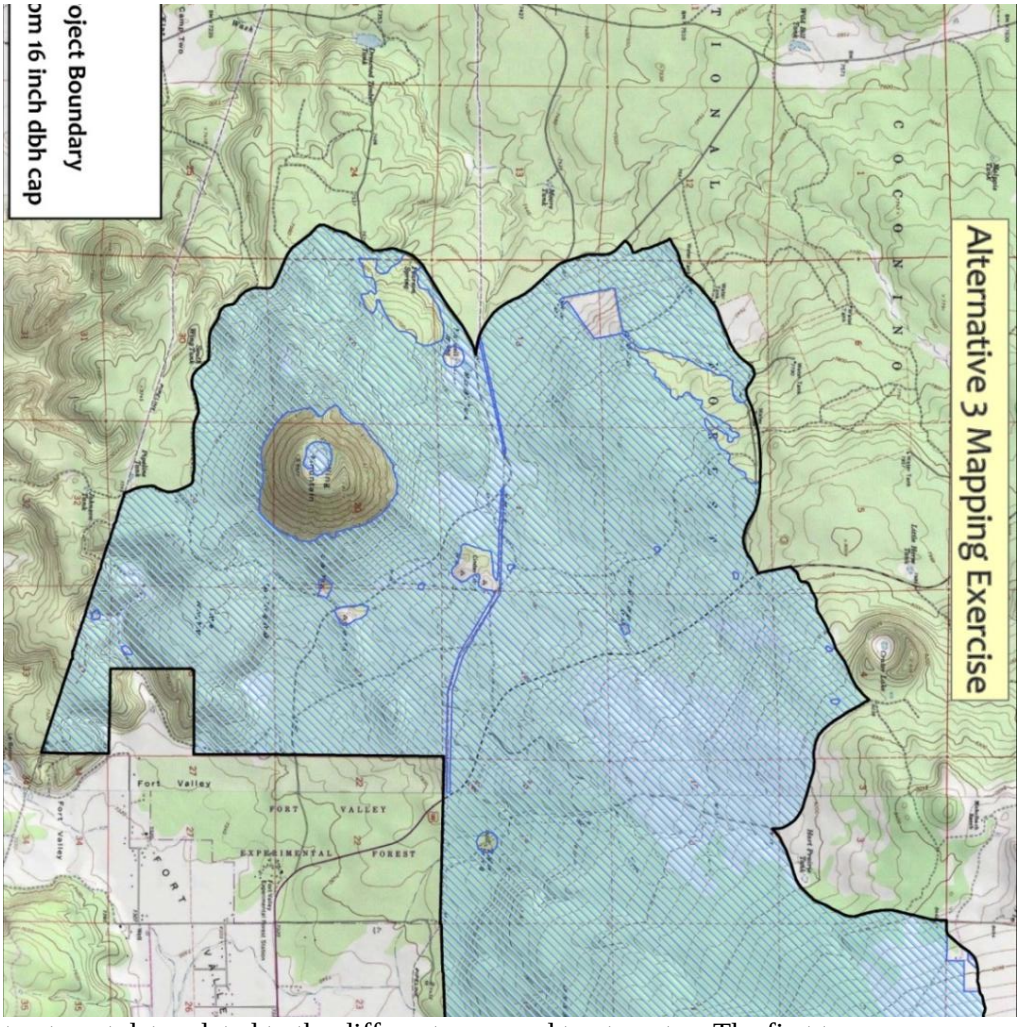
Under Alternative 2: The Proposed Action, 16 inch dbh trees would not be cut in the following areas (approximately 1,200 acres total or 10% of the project area):

- Seeps and Springs- No cutting of 16 inch+ dbh trees would occur within 100 meters from the center of the five springs within the project area. Acreage is approximately 39 acres.
- Riparian Stream Courses- No cutting 16 inch+ dbh trees 100 meters around riparian stream courses; no riparian stream courses are located within the project area.
- MSO Fuels Reduction Treatment Areas (Forest Plan restricts cutting in MSO PACs to 9 inches dbh and below): acreage is approximately 392 acres.

- Burn Only Treatment Areas- No trees would be cut in these areas according to the proposed action described in Alternative B; acreage is approximately 577 acres.
- No Treatment Areas – No trees would be cut in the areas according to the proposed action described in Alternative B; acreage is approximately 200 acres (includes approximately 18 acres of private land).

The remaining 90% (10,000 acres) fall within the "exception" categories listed in the LTRS, and thus would allow the cutting of trees 16 inch dbh and greater (Figure 4). These "exception" categories include restoring encroached grasslands/meadows, regenerating aspen, and developing diversity in age classes and openings within ponderosa pine.

Figure 4: Map of areas excepted from a 16 inch dbh cap (where 16 inch trees may be cut)



The table below shows treatment data related to the different proposed treatments. The first two columns show the current basal area (BA) and trees per acre (TPA) of the stands within those treatment areas. In general, the Wing Mountain project has an average of over 20 TPA larger than 16" dbh. The third and fourth columns show the BA and TPA of 16"+ trees that would be cut. The fifth column shows the number of trees that would be cut between 16" and 18" dbh. In the Wing Mountain project, the majority of the trees greater than 16 inches dbh that would be cut are mostly between 16" and 18" dbh. The last three columns show the desired BA, the BA after treatment of the proposed action, and the BA of the proposed action if there was a 16" dbh cap on the treatments.

Treatment	Current BA of 16" + Trees	Current TPA of 16" Trees	BA of 16" + trees cut	TPA of all 16" + trees cut	TPA of 16"-18" trees cut	Desired BA at stand level	BA of Alternative 2: Proposed Action	BA of Alternative 3: Proposed Action with 16" cap

Ponderosa Pine Restoration-Goshawk Foraging Treatment	44.7	21	19	10.7	6.6	50+ in VSS 4, 5, & 6	51	70
Ponderosa Pine Restoration with northern goshawk PFA Treatment	41.9	19.1	10.1	5.8	3.7	70+ in VSS 4, 5 & 6	66	76
Ponderosa Pine Restoration with northern goshawk PFA Nest Areas Treatment	36.1	16.2	3.6	2	1.2	50 -70	71	75
Grassland with Pine Savannah Restoration Treatment	81.5	36.8	58.1	29	12.4	30	31	88
Target Threshold - Treatment	123.9	35.6	28.5	15.6	10	160	160	199
Fuel Treatment outside MSO PACs	52.4	26.17	2	2.1	1.4	70	98	100
Aspen Restoration Treatment	69.6	34.8	16	9.6	7.1	Minimize Conifer BA	Conifers = 34	Conifers = 50

Comparison of Alternatives

This section provides a summary of the issues defined by the scoping process and evaluates the measures for each alternative.

Table 6: Summary of Environmental Consequences by Alternative

Issue to Compare	Alternative 1— No Action	Alternative 2 -- Proposed Action
Fire and Fuels	Does not meet the purpose and need to reduce fire hazard and move the forest toward the historic fire regime behavior, severity and patterns.	Reduces fire hazard and moves the forest toward the historic fire regime behavior, severity and patterns.

Issue to Compare	Alternative 1— No Action	Alternative 2 -- Proposed Action
Soils/Watershed	Continues the risk of a stand replacing, high intensity fire. Such a fire would have a negative effect to soils directly after due to the possibility of increased erosion, loss of vegetation and soil nutrients.	Short term impacts from temporary road construction, prescribed burning, and thinning activities would occur, with long term benefits to resources. Best Management Practices (BMPs) would be utilized to mitigate any impacts from ground disturbing activities. Spring restoration would improve watershed health. This alternative not expected to detrimentally affect water quality.
Wildlife	No direct effects, but would result in the continuation of long-term degradation of habitat (i.e. dense tree canopies, low resistance to catastrophic fire/bug and insect infestation, low tree size diversity).	Potential minor, short-term effects to some threatened and endangered or sensitive species (i.e. smoke, noise, loss of some snags), with long-term benefits of improved habitat. Design features (Chapter 2) minimize impacts to wildlife.
Vegetation	Desired Conditions would not be achieved. Mortality risk for all trees is high, due to risk of stand-replacing fire. Portions of old growth habitat would experience increased competition for moisture and nutrients, leading to increased risk of mortality to large trees. Understory vegetation is reduced due to high densities and canopy cover in the project area.	Long-term mortality risk of large trees would be reduced and old growth would be protected. Treatments would move the forest toward Forest Plan desired conditions. Understory diversity and productivity would be improved.
Roads	No new temporary road construction. No existing roads would be decommissioned or obliterated.	Approximately 3.25 miles of temporary road construction, which would be decommissioned following project implementation. Approximately 48.88 miles or road would be decommissioned, and five miles would be fully obliterated.

Chapter 3 - Environmental Consequences

This chapter provides information concerning the affected environment of the Wing Mountain Fuel Reduction and Forest Restoration Project area, and potential consequences to the environment from the two alternatives. It also presents the scientific and analytical basis for the comparison of the Proposed Action and No Action Alternative including direct, indirect and cumulative effects. Effects are quantified where possible, and qualitative discussions are also included. The means by which potential adverse effects would be reduced or mitigated are described (see also Chapter 2). The Project Record for the Wing Mountain Fuel Reduction and Forest Restoration Project (accessible at the Flagstaff Ranger District) includes all project-specific information, including resource reports, watershed analyses, and other results of field investigations.

This summary of the effects analysis is organized to first focus on those resources directly related to the purpose and need and the issues defined by scoping and analysis. Brief summaries of additional analyses follow. More detailed discussion for all resources and environmental consequences can be found in the specialist reports in the Project Record.

Fire and Fuels

Affected Environment

Current conditions in the Wing Mountain project area suggest that the area is at risk for unnatural, high severity fire, thus valuable natural resources, private and federal property, and cultural resources may also be at risk (See also Purpose and Need – Wildfire Risk and Property Protection, Chapter 1).

Forest Plan guidance allows for the use of wildland fire from naturally ignited fire in all of the Management Areas (MAs) within the Wing Mountain project area except for MA 20 (Highway 180 corridor). This MA consists of 832 acres of the 11,143 acre project area. Future management actions for wildfire in this 832 acre portion of MA 20 falling within the Wing Mountain project area will continue to be full suppression regardless of the alternative, and would include the use of firefighting personnel and equipment as appropriate (i.e. fire engines, bulldozers, etc.).

Fire hazard ratings measure how intense and virulent a fire would burn under hot, dry, and windy conditions during April through July. The fire hazard ratings and the corresponding acreages for the Wing Mountain Project area are as follows:

Extreme- 3,807 acres
Very High- 1,336 acres
High- 2,967 acres
Moderate-2,248 acres
Low- 785 acres

High to extreme fire hazard ratings in the project area were attributed to high fuel loadings, low crown base heights, a large number of trees per acre, and/or large percentages for canopy closure.

Crown fire potential was also analyzed for the Wing Mountain Project area using the crown fire GIS data layer from Forest Ecological Restoration Analysis (ERA) database. Three types of fires are described in the data layer: surface fire, passive crown fire, and active crown fire. Surface fire describes fire that burns through the surface fuels of the forest floor. This type of fire has the least active of fire behaviors and is the most beneficial of the three types of fires in maintaining the historical, ecological role of low intensity, high frequency fire in the southwestern ponderosa pine ecosystem. Passive crown fire, or torching, occurs when flame lengths are long enough to reach the lower edge of the canopy and can result in individual or small group tree torching but does not proliferate through the forest canopy through continuous crown fire spread. Active crown fire occurs when flames reach the forest canopy and spread through it with intensity and continuity.

According to Forest ERA modeling data, existing crown fire potential for the Wing Mountain Project area is as follows:

Surface fire	665 acres	(6%)
Passive crown fire	3,531 acres	(32%)
Active crown fire	6,947 acres	(62%)
TOTAL	11,143 acres	

Thus, the majority of the project area has a greater potential for passive and active crown fire than surface fire. This result is most likely due to heavy fuel loadings, low crown base heights, high crown bulk densities, and high percentages of canopy closures across the project area when coupled with dry, hot, and windy weather conditions and terrain influences such as steep slopes and south to southwest aspects.

Fire regimes and condition classes are used to help describe the existing ecological health and condition of the project area in relation to the historical role of fire in the Wing Mountain Project area. In general, there are five natural fire regimes and three condition classes. A fire regime generally classifies the historic role of fire over the landscape in the absence of modern human mechanical intervention. The fire regime condition class (FRCC) quantifies the amount that current vegetation has departed from the simulated historical vegetation reference conditions due to an absence of fire and a subsequent increase in fire return intervals. A brief description of both fire regime and condition class is provided below in Table 7.

Table 7: Summary Fire Regime and Condition Class Acres

Fire Regime I: 0-35 year fire return interval , surface to mixed burn severity		
Condition Class Level 2- moderate vegetation departure	**Uncategorized**	**Condition Class Level 3- high vegetation departure**
568 acres	10 acres	10,473 acres
Fire Regime II: 0-35 year fire return interval, high burn/stand replacement severity		
Condition Class Level 2		**Condition Class Level 3**
0 acres		<1 acre
Fire Regime III: 35-200 year fire return interval , surface to mixed burn severity		
Condition Class Level 2		**Condition Class Level 3**
0 acres		91 acres

Most of the project is in fire regime one, condition class level three (10,473 acres) due to the fire return interval in the area being greater than the historical fire return interval. Due to this deviation between the current and historical intervals, a wildfire occurring under the existing condition would result in more severe effects to ecosystem components than should occur for the natural fire regime.

Fuel accumulations left by the tornados exceed 50 tons/acre in some areas within the project. Fuel loadings prior to the storm would generally have fallen below 10 tons/acre. Also, tornados disturbed vertical arrangement of fuels within the project area and created fuel heights ranging in many areas 5 to as much as 10 feet. Fuel heights prior to the storm in most areas were less than one foot.

The amount of blow down varies widely depending on stands and storm strength, with tree damage ranging from 25% to 75% of trees within the tornado's destruction path. The resulting increased fuel heights contribute to a greater potential for spotting if a wildfire were to take place under dry, hot conditions, especially in areas that are intermixed with undamaged live trees. Furthermore, increased fuel heights could also negatively affect fire behavior and increase the potential for crown fires and crown fire spread within affected stands.

Environmental Consequences

Alternative 1: No Action
Direct and Indirect Effects

No fuel reduction and no change in vegetative structure of the forest within the Wing Mountain Project area would occur under the No Action Alternative. This Alternative would not result in reducing existing fire hazard within the project area. Not implementing fuel treatments including thinning and prescribed burning would encourage unhealthy ecosystem conditions, including heavy fuel loading, increased risk for high-intensity wildfire, and flame length to persist. These conditions would persist because fuel loading would continue to accumulate on the forest floor without the reintroduction of low intensity, high frequency fires by periodic prescribed burning consisting of three to seven year burn intervals. Also, without thinning the number of trees per acre would continue to rise both in the forest and in areas that were historically grasslands/meadows, creating conditions with more continuous fuels vulnerable to high intensity fires that result in a high severity of effects.

Table 8: Existing conditions for Wing Mountain Project Area according to proposed treatment area

Proposed Action Treatment Area	*Tree per acre*	*Crown Base Height (ft)*	*Crown Bulk Density (kg/m^3)*	*Canopy Closure (%)*	*Potential Surface Flame Lengths(ft)*	*Crowning Index (mi/hr)*	*Torching Index (mi/hr)*	*Potential Tree Mortality (%Basal Area)*
Aspen Restoration Treatment Area	708	10	0.062	82	4	40	39	63
Fuels Reduction Thin from	430	13	0.072	71	8	30	59	55

Below								
MSO PAC Treatment	545	9	0.082	76	7	28	31	81
Goshawk PFA Nest Treatment Area	330	14	0.074	68	8	31	77	26
Goshawk PFA Treatment Area	386	17	0.067	69	8	31	80	48
Grassland Savannah Treatment Area	320	9	0.107	73	11	23	16	99
Burn Only Treatment	529	7	0.09	73	3	23	46	49
Mixed Conifer Treatment	342	14	0.08	88	3	26	86	10
Ponderosa Pine Restoration Treatment Area	321	18	0.076	70	7	29	115	55
Target Threshold Treatment Area	923	7	0.135	91	5	18	61	100

Without periodic prescribed burning, crown base heights would also continue to remain low, which would result in more crown ladder fuels and with that, in addition to greater crown bulk densities, an increase in the potential for passive and active crown fires to occur within the forested stands of the project area during hot, dry weather conditions. High intensity, stand replacing fire would initially reduce the dead and down fuel within the project area, but it would do so at the cost of negatively altering existing ecosystem condition and diversity (vegetation, wildlife, soils, watershed, etc.), potentially destroying adjacent private property, and damaging heritage resource sites. As time goes by, dead and down woody fuel would increase, potentially increasing fire hazard as dead trees and other dead fuels produced as a result of the stand replacing fire fall to the forest floor (Greenlee and Greenlee 2002).

Under this alternative, when a wildfire occurs, expected flame lengths occurring under modeled conditions would exceed four feet in many sites, making it difficult and unsafe for initial attack crews to control a wildfire and resulting in tree mortality (Brown et.al. 2004). The average surface flame lengths under severe weather conditions commonly range from five to six feet over all treatment areas. When looking at existing conditions of stands according to fuel model distinction, many areas have flame lengths that could potentially reach eleven feet. These averages seem to be surprisingly low considering many individual stands within the treatment areas consist of as much as ten to thirty tons per acre of down and dead woody debris. However, many of the sampled stands have close to 0.1 kg/m^3, the minimum average crown bulk density

necessary to sustain crown fire activity (Agee 1996; Greenlee and Greenlee 2002). Furthermore, canopy closure exceeds 60% in many stands.

Table 9: Existing Conditions according to fuel model for the Wing Mountain project area

Measure	**Existing Conditions for each Fuel Model** (fuel models described in Scott and Burgan (2005)).					
Primary surface fuel carrier	Grass and at least 50% shrub	Grass or shrub with needle litter from forest canopy	Forest litter with a shrub or small tree understory	Conifer litter	Conifer litter	Needle litter
Height to Live Crown (ft)	6-31	5-24	5-10	3-7	4-24	2-31
Dead and Down Fuel (tons/acre)[avg]	0	0-20 [6]	2-17 [7]	8-23 [16]	15-24 [20]	1-34 [9]
Canopy Closure (%)	60-76	58-84	63-91	75-98	68-86	43-89
Flame length (ft)	6.5	2.5	11	2	4	6

Alternative 1 leaves much of the area in condition class III (a severe departure from the natural historical regime of vegetation characteristics, fuel composition, fire frequency, severity and pattern). As time passes, even more area would transition to condition class III and most likely further result in destructive wildfires more severe than the area's historic fire regime.

Average potential tree mortality within the treatment areas ranges from twenty-six to one hundred percent in the densest areas within the project area according to FVS modeling of a fire under severe weather conditions.

The indirect effects of Alternative 1 would include increased competition between trees for moisture, nutrients, and sunlight. This competition most likely would result in decreased tree vigor and increased susceptibility to insect infestation, disease, and mortality (see the Vegetation and Forest Health section of this chapter for more details). More dead trees would lead to an increased fuel load, fire hazard, and possible future insect infestation and attacks, such as from pine bark beetle, on remaining trees. Other indirect effects of Alternative 1 that could follow include possible damage and/or loss of private property in the vicinity of the project from a fire that would be difficult to control, such as a stand replacing fire.

Cumulative Effects

The cumulative fire effects analysis for this project includes past, present and reasonably foreseeable future projects located on the Flagstaff District. It constitutes most of the forested land subject to the prevailing winds driving a wildfire into the community of Flagstaff and the surrounding areas. The project area is within the Flagstaff Community Wildfire Protection Plan

area (CWPP) and the treatments proposed are in line with the goals and objectives set forth by the CWPP (2005).

A cumulative effect of the No Action Alternative would result in an increase the number of acres of national forest that would be vulnerable to severe fire effects. The vegetation type across the project area requires periodic fire to remain balanced. Fuel conditions have reached a point where fire effects are more severe than desired and more severe than would naturally occur. The fire hazard and fuel profile increases with time as the vegetation grows and dies. Other fuels reduction projects – 4FRI and Turkey Barney – would both occur down-wind of prevailing winds and thus would slightly counteract the increasing risk of high fire severity occurring in this alternative by reducing the threat of high-intensity wildfires downwind of this project.

Climate change is expected to result in more extreme wildfire events (Marlon et al. 2009). It is also expected to result in increased tree mortality in the Southwest (Van Mantgem et al 1009; Williams et al. 2010). These two changes resulting from climate change would combine with uncharacteristic forest conditions to have a cumulative impact of increasing risk of high intensity wildfires in the project area.

In addition to these wide-spread hazardous conditions, the 2010 tornado events had a concentrated effect on fuel loadings and fire hazard ratings in areas within and adjacent to the project area. In some of the affected areas, fuel loadings were increased to more than 50 tons/acre, with an increase in fire hazard ratings as either very high or extreme. Though a Forest analysis to remove the downed material and mitigate bark beetle infestation and the elevated fire danger was completed in 2011, it is unlikely that all the affected material will be removed due to low market values and operational difficulty. In addition, recent surveys for bark beetle activity related to the tornadoes have shown the presence of multiple bark beetle species within the tornado paths included in and adjacent to the project area (Anhold 2011). Jenkins et al. (2008) found that wind speeds increase within beetle-killed stands, which can lead to larger wildfires, especially in areas already experiencing heavy fuel loading and a severe departure from historic conditions, such as the Wing Mountain project area.

Implementation of the No Action Alternative, along with past, present, and reasonably foreseeable actions, would have cumulative effects relative to fire and fuel conditions within the project area. Most of the area surrounding the project area provides several popular recreational opportunities for the forest visitor, such as camping, hiking, scenic viewing, hunting, and riding ATV and/or UTVs, and is highly visited throughout the year although more so during the summer and fall months. Recreationists tend to build campfires during their stay in the forest. Some fires are started in established campfire rings and others in temporary campfire rings. A No Action Alternative would not change the existing ecosystem condition of the project area, therefore, the project area as well as surrounding areas would be at risk of carrying and sustaining a fire from outside the project area that would gain intensity in dry, hot, and windy conditions, creating a stand replacing fire that entered and traveled unheeded through the project area.

Alternative 2: Proposed Action
Direct and Indirect Effects

Thinning and introducing prescribed fire in the project area—especially in areas where fire hazard ratings are extreme to high and fire regime and condition classes are outside the natural range of variability— would lower the risk of uncontrollable wildfire that would produce

undesirable and perhaps detrimental effects to the ecosystem. Fuel treatments would modify vegetation structure and over time reduce fire return intervals which, in turn, should lower condition classes of stands from class three to classes one or two (thus restoring more historic vegetation densities). These treatments would also help with reducing threats of wildfire to values at risk within and adjacent to the project area, including urban areas that contain structures and ecological and cultural resource sensitive areas such as Gus Pearson Natural Area and Fort Valley Experimental Forest.

Modeling fire hazard after the proposed action treatments within the project area shows dramatic decreases in fire hazard. As Table 10 and Table 11 illustrate, the extreme, very high and high categories deceased substantially. Extreme fire hazard was reduced from 3,807 acres (34% of the project area) down to 0 acres (0%). Very high was reduced from 1,337 acres (12%) to 0 acres (0%). The high category was reduced further from 2,977 acres (27%) down to 193 acres (<1%). Studies also support the conclusion that treated stands decrease wildfire intensity and the damage to forest resources (Cram et al, 2006; Pollet and Omi et al 2002; Omi and Martinson, 2002; and Fulé et al, 2001).

Alternative 2 proposes to thin and prescribe burn 2,248 acres that are currently rated as having a moderate fire hazard. The majority of these acres would be assigned a low fire hazard rating after treatment. Alternative 2 also proposes to thin and prescribe burn 794 acres that are currently rated as low fire hazard. Although these acres already have a low fire hazard rating, the stand composition, conditions, and structure that can lead to extreme fire behavior would be changed to further reduce fire hazard and move those acres to a trajectory toward historic conditions. Without the proposed thinning and burning, both current and future stand conditions would most likely promote extreme fire behavior within the urban interface if a fire occurred within and surrounding areas of the project area.

Areas proposed for jackstrawing aspen restoration treatments would have an increased fire hazard rating mostly due to an increase in the amount of down woody debris per acre. The jackstrawing method would not be utilized in areas closest to the urban interface or where the prevailing wind could adversely affect the design of the treatment if a fire were to occur.

The fire regime for the majority of the project would remain the same: fire regime 1, which indicates an open forest maintained by frequent mixed intensity fires. The remaining portions of the project area are fire regime II (characterized by a fire frequency between 0 and 35 years, but with a higher severity[3] , and fire regime III (a mosaic of open forest to mid-seral maintained by mixed severity fires recurring generally 35 to 100 years). Over the course of 20 years, the condition classes would move very close to a condition class I, where vegetation composition, structure, and fuels are similar to those of the natural regime and do not predispose the system to risk of loss of key ecosystem components. Because this is a process that occurs over many years with many variables, it is difficult and ineffective to attempt to quantify FRCC changes in acres. However it is accurate to say that a wildfire occurring under post-treatment conditions would be characteristic of the historic fire regime behavior, severity, and patterns.

[3] more than 75% of the dominant overstory replaced

Table 10: Pre and Post treatment conditions for Wing Mountain project area according to treatment area. Values are averages

Proposed Action Treatment Area	Tree per acre	Crown Base Height (ft)	Crown Bulk Density (kg/m^3)	Canopy Closure (%)	Potential Surface Flame Lengths(ft)	Crown-ing Index (mi/hr)	Torching Index (mi/hr)	Potential Tree Mortality (%Basal Area)
Aspen Restoration Treatment Area	708	10	0.062	82	4	40	39	63
Aspen Restoration Treatment Area- **Post Treatment**	314	15	0.023	69	3	43	81	33
Fuels Reduction Thin from Below	430	13	0.072	71	8	30	59	55
Fuels Reduction Thin from Below- **Post Treatment**	145	22	0.05	62	4	37	71	50
MSO PAC Treatment	545	9	0.082	76	7	28	31	81
MSO PAC Treatment – **Post Treatment**	176	22	0.063	72	6	35	58	53
Goshawk PFA Nest Treatment Area	330	14	0.074	68	8	31	77	26
Goshawk PFA Nest Treatment Area- **Post Treatment**	95	31	0.036	54	5	35	134	27
Goshawk PFA Treatment Area	386	17	0.067	69	8	31	80	48
Goshawk PFA Treatment Area- **Post Treatment**	97	29	0.033	59	5	54	107	40
Grassland Savannah Treatment Area	320	9	0.107	73	11	23	16	99

Grassland Savannah Treatment Area- **Post Treatment**	61	33	0.013	32	6	123	35	81
Burn Only Treatment	529	7	0.09	73	3	23	46	49
Burn Only Treatment- **Post Treatment**	529	7	0.09	73	3	23	46	48
Mixed Conifer Treatment	342	14	0.08	88	3	26	86	10
Mixed Conifer Treatment- **Post Treatment**	267	17	0.069	85	5	29	45	15
Ponderosa Pine Restoration Treatment Area	321	18	0.076	70	7	29	115	55
Ponderosa Pine Restoration Treatment Area- **Post Treatment**	100	26	0.024	45	3	67	90	52
Target Threshold Treatment Area	923	7	0.135	91	5	18	61	100
Target Threshold Treatment Area- **Post Treatment**	508	26	0.075	74	6	29	50	71

**Treatment refers to thinning only. Modeling results do not reflect effects from burning.*

In general, the average potential tree mortality would decrease approximately anywhere from three to fifty percent, according to modeling a fire under severe weather conditions in the project area. The proposed action for this treatment area calls for reducing canopy cover to forty percent and creating twenty percent canopy openings. Thus, even if torching occurred, it would occur by group torching that most likely would not initiate a sustained crown fire.

Aspen regeneration in the MSO target threshold treatment could account for lower post treatment torching indices. Modeling did not include cutting or reducing the number of aspen seedlings that currently reside on site in this treatment area. However, aspen is not known for proliferating and/or supporting extreme fire behavior. Thus, the decrease in the torching index post treatment probably does not model reality if the reason for low post treatment torching indices is due to not modeling cutting aspen seedlings in the treatment area.

Modeling the northern goshawk nest treatment resulted in a one percent increase in the average potential tree mortality compared to the potential tree mortality that would occur from a severe fire under existing conditions. However, modeling showed that potential tree mortality is relatively low (27%) under existing conditions compared to the potential tree mortality in the other treatment areas.

In some areas proposed for mechanical thinning, flame lengths after treatment would still be expected to occur over four feet, making direct initial attack of a wildfire occurring under severe weather conditions difficult to perform. However, according to modeling, treated stands in the project area would have crown bulk densities of 0.013 to 0.075 kg/m^3. Reductions in crown bulk densities in conjunction with increases in canopy openness as a result from thinning treatments would create forest stand conditions that would not be conducive to sustaining a crown fire under severe weather conditions.

In areas that would receive pile and broadcast burning in addition to thinning, dead and down woody debris would decrease anywhere from thirty-six to eighty-three percent from existing condition measurements, in turn reducing flame lengths. Modeled post treatment dead and down woody debris estimates are lower than the desired ranges stated in the Forest Plan. However, these estimates are modeled and do not necessarily reflect reality. Prescribed burns usually result in a mosaic of burn severity within a burn block rather than the entire block being burned with the same amount of severity. Mitigations adhered to during burning would avoid the potential of leaving an insufficient amount of dead and down fuels on the ground according to Forest Plan. Mitigations would include: 1) burning under weather and fuel conditions that would allow for more fuel to be left on the forest floor in areas where fuels loadings are close to Forest Plan guidance and/or, 2) managing time intervals for maintenance burning according to on site average down and dead fuel loadings and whether or not they are within the desired range stated in the Forest Plan. Furthermore, rapid fuel accumulation and slow decomposition rates have been found as typical ecological processes within treated and untreated ponderosa pine forests in northern Arizona (Sackett and Haase 1996). Therefore, even if down and dead fuel loadings were reduced to lower than the desired Forest Plan range, these reductions would only last a few years and would increase to the desired range directed in the Forest Plan during the time period of Wing Mountain project implementation.

Table 11: Average dead and down woody debris, pre and post thinning and burning

Proposed Action Treatment	Prior to any treatment	Post thinning and pile and broadcast burn	Percent Change from pre to post thinning and burning
Aspen Restoration Treatment Area	13	3	77% -
Fuels Reduction Thin From Below Treatment	12	2	83% -
MSO PAC Fuels Treatment	9	3	67% -

Proposed Action Treatment	Prior to any treatment	Post thinning and pile and broadcast burn	Percent Change from pre to post thinning and burning
Goshawk Nest Treatment Area	10	2	80% -
Goshawk PFA Treatment Area	12	2	83% -
Grassland Savannah Treatment Area	7	2	71% -
Burn Only Treatment (Broadcast Only)	12	5	58%-
Mixed Conifer Treatment	10	3	70%-
Ponderosa Pine Restoration Treatment Area	11	7	36% -
Target Threshold Treatment Area	14	3	79% -

Alternative 2 would result in a short-term (approximately one year) increase in wildfire hazard potential while treatments are occurring; while the proposed thinning would reduce crown fire ladders, canopy closure, and crown loading, the thinning slash would usually be piled on site, thus increasing the dead and down fuel loading until the piles are burned. However, until the material composing these piles dries out, they would not pose a significant hazard and the piles would be burned soon after they dry out (usually one year after piles have been constructed). By timing thinning activities and piling activities so that the slash piles do not pose a hazard for an extended period of time, this short term increase in fuel hazard would be offset by a long-term decrease in wildfire hazard.

Alternative 2 addresses the purpose and need by reducing the crown bulk density (thinning), reducing the canopy closure (thinning), increasing the effective crown base height in most sites (thinning and prescribed burning), and reducing the number of potential firebrands and shortening the distance at which spot fires would be expected to occur (thinning and prescribed burning). Furthermore, Alternative 2 would meet the project goals and objectives because the fire hazard would be reduced in the project area, and community protection and resource protection would still be improved over the No Action Alternative.

Cumulative Effects

The cumulative effects boundaries for the Proposed Action are the same as those described under the No Action Alternative.

Fuel reduction treatments within the wildland urban interface would reduce expected fire behavior to a level at which a small number of personnel could quickly and effectively control a wildfire. The objectives of the proposed treatments would be to reduce the possibility that wildfires could become established and would also reduce the intensity with which wildfires could burn. These reductions would further reduce the probability that the demand on emergency response personnel would be exceeded and reduce the threat to life and private property. Wildfires would be controlled with fewer acres burned, resulting in less damage to National Forest lands. Also, wildfires would burn less severely, resulting in less resource damage to each acre burned.

The Wing Mountain project would cumulatively combine with other forest health and fuel reduction projects that lie in the path of the prevailing winds around Flagstaff and its suburbs (Hart Prairie, Eastside, Ft. Valley Restoration, A-1 Multi-Product, Mars Hill, Ritter, Sinks, Mormon Lake Basin, Woody Ridge, Kachina Village, Lake Mary, Mountainaire, Elk Park, Jack Smith Schultz, Marshall and Skunk Fuel Reduction and Forest Health Projects). The treatments within these projects do not eliminate the chance of a crown fire, but have greatly reduced the chance of a crown fire initiating within their bounds.

The Flagstaff District completed data collection last summer (2011) in the Turkey Butte-Barney Pasture project area, located approximately thirty miles south of the Flagstaff area, and a decision on the project is anticipated in mid-2013. However, this project would not have an effect on the fire behavior or fire hazard of the Wing Mountain area due to the distance between the two projects.

The Four Forests Restoration Initiative (4FRI) team has started the planning process for the landscape scale project, which consists of implementing landscape restoration treatments on over 2.4 million acres of the Coconino, Kaibab, Apache-Sitgreaves and Tonto National Forests, the first phase of which includes treatments on approximately 750,000 acres of the Coconino and Kaibab National Forests over the next ten to twenty years. The 4FRI planning efforts would potentially have an impact on reducing fuel loading and fire hazard on the Flagstaff District once treatments have been implemented over the landscape.

Since existing conditions and proposed treatments vary widely across these projects and even within individual projects, it is difficult to summarize the fire effects. However it is accurate to state that fire-induced tree mortality across all size classes would be dramatically reduced by these treatments. It is also accurate to state that wildfires occurring in these treated areas would be easier to control and burn less severely with less acreage burned than if the areas were left untreated. These projects combine to form a defensible space for Flagstaff and its surrounding communities.

As discussed under the cumulative effects analysis for the No Action Alternative, climate change is anticipated to increase the frequency and severity of wildfires and tree mortality. The proposed activities would counteract these effects by the decreasing the risk of high severity wildfire in the project area (Hurteau et al. 2008; Westerling et al. 2006).

Vegetation and Forest Health

Affected Environment

The project contains five different cover types which are displayed in **Error! Reference source not found.**. Forest Plan guidance for northern goshawk habitat and Mexican spotted owl habitat apply to much of the project area (see Wildlife section).

Historically, ponderosa pine and dry mixed conifer forests of northern Arizona were characterized by frequent, low-intensity surface fires occurring every 2 to 12 years in the ponderosa pine and 3 to 21 years in the mixed conifer. The historic fire regime maintained an open canopy structure and a variable, patchy tree distribution across much of the forest by thinning smaller trees (Moir et al. 1997, Covington et al. 1997, Heinlein et al. 2005). Prior to Euro-American settlement, ponderosa pine forests in the southwest were uneven-aged and consisted of fewer smaller diameter trees and a greater number of larger, older trees arranged in groups and interspersed with grassy openings. After Euro-American settlement, several conditions, including fire exclusion, livestock grazing, high-grade timber harvesting, and climatic events, favored dense ponderosa pine regeneration (Long and Smith 2000). Much of the older age classes were removed during the railroad logging era and subsequent high-grade timber harvesting. In 1919, an unprecedented regeneration event occurred, resulting in massive amounts of pine seedlings. Due to fire suppression, these seedlings continued to grow in dense stands, forming a closed canopy across much of the landscape and effectively inhibiting further regeneration of shade-intolerant ponderosa pine. As a result of these factors, ponderosa pine forests of the southwest are now predominantly "even-aged" and consist of dense, overstocked stands of ponderosa pine with closed canopies and few trees less than 5 inches dbh or greater than 24 inches dbh.

Changes in historic fire regimes, along with other events that have occurred over the past century, have resulted in increased stand densities, changes in age and size class diversity, altered stand structure and species composition, changes in successional dynamics, altered insect and disease dynamics, decreased understory productivity and diversity, decreased tree health, growth and vigor, increased fuel accumulation and continuity, increased crown fire potential, and increased fire size and intensity (Covington and Moore, 1994; Johnson, 1994; Keane et al., 2002; USDA FS, 2007).

Forest Structure

Ponderosa Pine and Mixed Conifer

The Forest Plan requires Vegetation Structural Stage (VSS) and canopy cover to be evaluated at three different scales in order to address northern goshawk habitat needs. The following describes how the three scale analysis for VSS was completed:

- ***Small Scale:*** For the small scale VSS analysis, 495 points were evaluated and given a point-level VSS designation. The Forest Vegetation Simulator (FVS) was used to calculate the average basal area per acre within each VSS class for each of these points. The point-level VSS designation represents the VSS class that contained the highest basal area. These point-level VSS designations, once evaluated and analyzed, were then used to conduct the small-scale analysis.

- ***Mid-Scale:*** For the mid-scale VSS analysis, 110 stands were evaluated and given a stand-level VSS designation. The Forest Vegetation Simulator was used to calculate the

average basal area per acre within each VSS class for each of these stands. The stand-level VSS designation represents the VSS class that contained the highest basal area. The list of VSS designations for each stand is too extensive to place in this document, but can be found in the project record. These stand-level VSS designations, once evaluated and analyzed, were then used to conduct the mid-scale analysis.

- ***Landscape Scale:*** For the large scale VSS analysis, all the stand level data for the entire goshawk habitat area was averaged to generate one value.

Forest Plan standards and guidelines for VSS distribution and canopy cover apply only to northern goshawk habitat; specifically, the ponderosa pine, mixed-conifer, and spruce-fir cover types. Canopy cover guidelines apply only to mid-aged to old-growth forest (VSS 4-6) within these cover types. See Table 12 for VSS class definitions, existing VSS conditions for the project area, and the Forest Plan requirements for VSS.

The existing condition deviates substantially from the guidance included in the Forest Plan, and the current trajectory of growth would never meet that guidance. Large scale analysis is shown in Table 12. All three levels of analysis show that the goshawk habitat area is dominated by VSS 3 and 4 in ponderosa pine and VSS 3,4 and 5 in mixed conifer; VSS 1, 2, and 6 are lacking across both vegetation types, and VSS 5 is lacking in ponderosa pine. There is a need to create openings and introduce new VSS 1 and 2. In addition, there is a need to thin the VSS 3 and 4 stands to promote the growth of larger trees and reduce large tree mortality (Richie et al. 2008). Canopy cover was calculated by Forest Vegetation Simulator modeling from average stand basal area measurements. Canopy cover in northern goshawk habitat mostly consisting of ponderosa pine and mixed conifer forest ranges from 71 to 73 %, basal area (a measure of forest density) ranges from 140 to 156 square feet/acre, and trees per acre range from 312 to 385. These measures indicate a need to thin the forest to reduce canopy cover and density to meet desired conditions of the Forest Plan.

Minimum canopy cover requirements for VSS 4, 5, and 6 within northern goshawk foraging areas and post fledgling areas will be averaged and met across the stand. Trees will be arranged in groups and clumps with interspaces in-between groups. Interspaces would range from 10 to 30% of the area across the stand.

Table 12: Existing Vegetative Structural Stages (VSS) at the stand level by percent in the Ponderosa Pine and Mixed Conifer within the Wing Mountain Project Area

Forest Structure	VSS Class*	DBH (inches)	% in Ponderosa Pine	Need for Change	% in Mixed Conifer	Need for Change	Forest Plan Direction
Openings	1	0 – 1	2	+8%	0	+10%	10%
Seedlings and Saplings	2	1 – 5	1	+9%	0	+10%	10%
Young Forest	3	5 – 12	37	-17%	21	-1%	20%
Mid-Aged Forest	4	12 – 18	40	-20%	33	-13%	20%
Mature Forest	5	18 – 24	14	+6%	29	-9%	20%
Old Forest	6	24+	5	+15%	17	+3%	20%

** There are approximately 495 acres of ponderosa pine forest within the project area that were clear-cut or lost to high intensity wildfire. These areas are not reflected in the VSS tally in Table 12 because they have not yet been successfully regenerated.*

Aspen

The northwest area of Wing Mountain Project was historically rich in fairly healthy, mature aspen stands, where aspen dominated the overstory but conifers (ponderosa pine, southwestern white pine, and Douglas fir) either dominated the mid and understory layers or were not present. The aspen stands around Wing Mountain are typically mixed in with ponderosa pine and occur in smaller groups and clumps. Over the past 10 years, the majority of aspen sites across the project area have sustained greater than 60% aspen mortality (Fairweather et. al. 2008). This mortality is the result of severe drought events, late season frosts, western tent caterpillar defoliation, multiple secondary insect agent attacks, ungulate browsing, and historical fire suppression. The well-documented reduction of fire in southwestern United States since ca. 1900 is coincident with a dramatic decline in aspen cover (i.e., 95% reduction in Arizona and 88% in New Mexico) (Johnson 1994; Bartos 2001) and, consequently, the lack of large aspen stands dating to the 20th century (Margolis et al. 2007). According to Keane (2002), "[Aspen] is maintained by periodic mixed- to high-severity fires that kill most trees and allow aspen to regenerate from root suckers. The lack of fire has allowed the encroachment and dominance of conifers in many aspen stands."

Table 13 displays existing conditions within the aspen cover type in the Wing Mountain project area, including basal area and trees per acre. While total basal area of all species within the aspen cover type averages 198 ft² per acre, the basal area of aspen averages 104 ft² per acre. The remaining basal area is made up by conifers, such as ponderosa pine, southwestern white pine, and Douglas-fir.

While the project area averages 707 trees per acre, the number of aspen per acre averages 303 aspen per acre. More than half of the trees in aspen stands are conifers, most of which are in the understory. The high density and proportion of ponderosa pine and mixed conifer within the aspen cover type is the result of conifer encroachment due to fire suppression and a lack of aspen regeneration success due to ungulate browsing.

Table 13 also displays average diameter at breast height within the aspen cover type. The average dbh for aspen is 8.4 inches. The vast majority of aspen clones within the project area are mid-aged to mature, with few trees less than 5 inches dbh.

Table 13: Average basal area, trees per acre, and average dbh within the aspen cover type

BASAL AREA ALL SPECIES	BASAL AREA ASPEN	TREES PER ACRE ALL SPECIES	TREES PER ACRE ASPEN	Average DBH
198	104	707	303	8.4

Grasslands and Meadows

Approximately 835 acres within the project area have been identified as historically open grasslands and meadows. Many of these grasslands and meadows have been experiencing pine encroachment for over 100 years due to fire suppression.

There are also some large grassland areas that include portions of the project area. The southern part of Hart Prairie is located in the north end of the project area, and a couple of large grassland areas located north of Wing Mountain. Within the grassland area, approximately 173 acres have been identified as pine savannah. These are areas that function like mountain grasslands but historically have had trees occurring within these grassland areas. The Coconino National Forest historic timber atlas and old aerial photos (1949), along with on the ground observation, indicate that these were historically very open areas.

The Hart Prairie grassland has been experiencing encroachment of ponderosa pine, Douglas-fir, and limber pine. The meadows north of Wing Mountain have also been experiencing encroachment of mostly ponderosa pine. The majority of the trees encroaching into the grasslands are less than 90 years old with most being less than 50 years old. Field observations have shown little sign of this area having sustained a forest like condition in the past. There are very few mature trees present and very few stumps to indicate that forest conditions were historically present in this area. In the grassland areas with pine savannah conditions, field observations have shown between 5 and 15 trees historically.

Old Growth

The old growth specifications for ponderosa pine, mixed conifer, and aspen cover types can be found in the Coconino Forest Plan (page 70-2). Table 14 shows the acres of existing old growth broken out by cover type and overall percent of each cover type that meets the current standard of existing old growth.

Table 14: Acres of developing old growth and acres and percent of existing old growth by cover type and site potential located within the Wing Mountain EMA

Cover Type	Acres of Cover Type	Acres of Developing	Acres of Existing	% Old Growth	Acres needed for 20%
Interior Ponderosa Pine – High	9196	1436	460	5%	1379
Mixed Species Group – High (Mixed Conifer)	768	228	267	35%	0
Aspen	272	0	213	78%	0
TOTAL		**1664**	**940**		**1379**

According to the Coconino National Forest Plan, old-growth forest should also be analyzed at multiple scales – one scale above and one scale below the ecosystem management areas. The three scales used to analyze old-growth for this project include:

- *Small scale* – at the stand level.
- *Mid-scale* - the ecosystem management area level (EMA). EMA was chosen due to Forest Plan direction.
- *Large scale* - across the Coconino National Forest.

This analysis only looks at the forest types that occur and would be managed in this project. They include ponderosa pine, mixed conifer, and aspen. The mixed conifer in this analysis looks only at Douglas-fir and limber pine stands.

Small Scale: Rocky Mountain Research Information System records indicate there is no old growth currently identified within the Wing Mountain project area; however using stand exam data collected for this project, 939 acres were identified as meeting the minimum criteria for old growth. An additional 1664 acres have been designated as developing old growth.

Mid-Scale: The project area is comprised of one EMA, the Wing Mountain EMA. According to the Forest Plan, no less than 20% of each forested ecosystem management area should be allocated to old-growth. Currently 939 acres of stands within the Wing Mountain ecosystem management area meet the minimum criteria for old-growth forest, as outlined in the Forest Plan. The remaining stands of the Wing Mountain EMA were analyzed for suitability for designation as developing old growth, and a total of 1,664 acres were designated. All protected stands, target threshold, and goshawk nest stands were designated as developing old growth. Stand exam data was used to identify additional stands that contained high numbers of large trees and large snags; a number of these stands were also designated as developing old growth.

Landscape Scale: Across the Coconino National Forest, approximately 81,239 acres of ponderosa pine, 30,904 acres of mixed conifer, and 927 acres of aspen forest have been identified as existing or developing old-growth. These acres constitute approximately 10.5% of ponderosa pine, 14.0% of mixed conifer and 9.2% of aspen. The reason that less than 20% of the forest types have been designated as existing or developing old growth is because not all areas on the Forest have been analyzed since the implementation of the Forest Plan. Also, there are large areas of the Forest such as Designated Wilderness, steep slopes, and isolated forest patches in canyons and cinder cone peaks that may meet old growth requirements, but would not be treated. As new vegetation projects are analyzed, more acres will likely be designated as existing or developing old growth.

Forest Health

Dwarf Mistletoe

Dwarf mistletoe (DM) is a parasitic plant that infects ponderosa pine and Douglas-fir and depends almost completely on its host for water and nutrients. Infected host trees experience reduced tree growth and vigor, reduced seed production and viability, branch deformations, a predisposition to bark beetles and root disease, and shortened life span and mortality (USDA Forest Service 2009). DM is considered a tree pathogen because infection results in significant changes in physiological processes and structural characteristics of infected trees, which in turn result in changes in the structure and function of forest communities (USDA Forest Service 2009). Overall effects on forest structure in a site that has been infected for many generations include: increased stand openings; lower crown base height; denser canopy cover due to witches' brooms; and fewer large diameter trees.

With increases in host abundance over the past 150 years and decreases in fire frequency, it can be inferred that dwarf mistletoe abundance was likely lower in the historic period (USDA Forest Service 2009). Since Euro-American settlement and the advent of fire suppression, DM populations in the southwest are thought to have increased with increased forest densities (Conklin 2010). A more open, park-like forest structure with frequent fire would have limited the spread of DM infection. Fire history is one of the primary ecological factors in determining the distribution and intensity of dwarf mistletoes in coniferous forests. Relatively complete burns may have a sanitizing effect on infected stands; while partial burns can lead to rapid infection of regeneration if scattered infected trees remain overtop newly established regeneration. Fire, both

prescribed and natural, can have a sanitizing effect, in which heavily infected trees and the lower branches of moderately and lightly infected trees are killed by fire, thereby lowering infection levels.

The severity of dwarf mistletoe infection with in the ponderosa pine and Douglas-fir tree for the Wing Mountain Project area is displayed in Table 15. For this project, DM infection was considered "severe" if the mean dwarf mistletoe rating (DMR) for the stand was 2.0 or greater. DM infection was considered "moderate" if the mean DMR for the stand was between 1.0 and 1.9. DM infection was considered "light" if the mean DMR for the stand was less than 1.0.

Table 15: The severity of dwarf mistletoe infection within the Wing Mountain Project area

DWARF MISTLETOE SEVERITY	Percentage of Ponderosa Pine Plots	Percentage of Douglas-fir Plots
LIGHT 0 - 0.9	8	17
MODERATE 1.0 – 1.9	9	8
HEAVY 2.0 +	22	6

Bark Beetles

Bark beetle species known to cause ponderosa pine mortality within the project area include roundheaded pine beetle (*D. adjunctus*) and western pine beetle (*D. brevicomis*). Mountain pine beetle (*D. ponderosae*) has been found in very low numbers on white pine (primarily) and ponderosa pine at higher elevations on the San Francisco Peaks, and should not be an issue within the project area.

High stand densities within certain portions of the project area signify moderate to high inter-tree competition and decreased tree vigor. Natural defense mechanisms against insect attack, such as the production of pitch, are limited at these densities, resulting in increased susceptibility to successful bark beetle attack and mortality. Recent bark beetle activity was observed in both ponderosa pine and Douglas-fir. A few years ago, an outbreak of mountain pine beetle caused a moderate to high level of mortality in mature Douglas-fir within and surrounding the project.

Within the ponderosa pine cover type, stands that have an average DBH greater than 12 inches (VSS 4 and 5) and a basal area greater than 120 ft² per acre are considered at high risk for bark beetle attack (USDA Forest Service 2009). Within VSS 4, 5, and 6 plots, average basal area averages 156 ft² per acre. Approximately 64% of this area is currently at moderate to high risk for bark beetle attack.

Within the mixed conifer cover type, total basal areas within VSS 4, 5, and 6 plots average 219 ft² per acre, placing most of the mixed conifer at moderate risk for bark beetle attack. About 15% of the plots have basal areas greater than 400 ft^2 per acre placing them at high risk.

In October of 2010 several tornados damaged forested stands in and around the Wing Mountain project area. An environmental analysis and decision notice was completed to treat the storm damaged stands and surrounding stands to deal with any potential forest health effects that may occur from a bark beetle outbreak. Subsequent monitoring shows that while bark beetles are infesting most storm damaged stands, many of the broken tops and trees are not being utilized by the bark beetles (USDA Forest Service, 2011). Currently, broken trees that are exposed to

sunlight are drying out and soon will no longer be an available food source for bark beetles. The Forest Service will continue to monitor the bark beetle activity in and around the storm damaged areas.

Environmental Consequences

Alternative 1: No Action
Direct and Indirect Effects

Ponderosa Pine and Mixed Conifer
Under the No Action Alternative, forest conditions and trends in ponderosa pine would remain much as they are now. Forested areas[4] would remain in an even-age condition; stands would continue to be dominated by VSS 3 and 4 size classes. Because of this, mature and old forest conditions would continue development at a slow pace and be at risk of increased rates of mortality (Ritchie et al. 2008, Davis et al. 2007).

In 20 years, canopy cover and basal areas would increase and trees per acres would decrease in both ponderosa pine stands and within the protected and restricted stands of mixed conifer. Closed crown canopies result in decreased sunlight to the forest floor, decreased understory productivity and diversity, increased inter-tree competition, decreased tree health, growth and vigor, increased insect and disease-related mortality (especially in older age classes), decreased understory productivity and diversity, and decreased horizontal heterogeneity (Fisk and Tappeiner, 2006; Fulé et al., 2007; Covington and Moore, 1994; Keane et al., 2002; Negrón et al., 2008).

Within the target threshold stands, due to the current extremely high density, basal areas and canopy cover would actually decrease due to high competition induced mortality. Target threshold stands would also have a higher rate of large tree mortality compared to the less dense restricted and protected stands (Fisk and Tappeiner, 2006). Closed crown canopies would result in similar effects discussed above. The current high fire hazard would continue to increase and greater amounts of unburned fuel continue to accumulate.

Aspen
Under the No Action Alternative, forest conditions within aspen stands would remain much as they are now. In 20 years, basal areas of both aspen and conifer species would increase and trees per acres would decrease. The basal area of conifers would increase at a greater rate than aspen and as a result, aspen would experience a faster rate of decline. Increased canopies of conifer species would compete with and shade out the shade intolerant aspen crowns (Stam et al., 2008). Closed crown canopies would result in the same effects discussed above.

[4] *Forested areas* is used to describe those areas within the project that are naturally forested, meaning trees have historically existed in those areas as compared to grasslands or meadows, which now have trees on them but historically did not. In general, *forested areas* is used when describing actions that would be done within the ponderosa pine and mixed conifer (MA 3 and 4) areas of the project.

Table 16: Average basal area and trees per acre for the Aspen Treatment areas under Alternatives 1 and 2

TIME FRAME	BASAL AREA ALL SPECIES*	BASAL AREA ASPEN*	TREES PER ACRE ALL SPECIES*	TREES PER ACRE ASPEN*
EXISTING CONDITIONS	198	104	707	303
POST-TREATMENT – Alternative 2	140	106	328	303
No Action +20 YEARS- Alternative 1	233	123	527	210
Post Treatment +20 YEARS- Alternative 2	183	143	306	281

**These numbers do not include anticipated aspen regeneration*

Grasslands and Meadows
The No Action Alternative would indirectly affect grasslands and meadows within the project area. Over the next 20 years, grasslands would continue to experience pine and mixed conifer encroachment. As conifer density increases over time, grasslands would experience decreased productivity and diversity and loss of functionality in terms of hydrology, biodiversity, and horizontal heterogeneity.

Old Growth
Under the No Action Alternative, stands would continue to develop at a slower pace and may eventually meet the criteria for old growth under the current Coconino Forest Plan. Current and increasing stand densities would continue to decrease the vigor and health of stands. Due to high density and fuel ladders, fire hazard would increase over time. Without treatment, the rate of mortality of existing yellow pines would increase. In the event of a high severity wildfire (which is more likely under the current conditions than the treated conditions), old ponderosa pines are more prone to dying than younger ponderosa pines (Kolb, 2007).

Forest Health

Dwarf Mistletoe and Bark Beetles
Under the No Action Alternative, there would be no direct effect on dwarf mistletoe infection because no trees would be harvested. There would be no change in the level of dwarf mistletoe infection from existing levels. However, the No Action Alternative would indirectly affect the level of dwarf mistletoe infection over the long term. Dwarf mistletoe infection would continue to spread throughout infected stands, expanding at a rate of 1-2 feet per year. Increased dwarf mistletoe infection would result in reduced tree growth, reduced tree vigor, branch deformations, and shortened life span of the infected host (Conklin, 2000). Reduced tree vigor and altered pitch flow associated with dwarf mistletoe infection would result in compromise of a tree's defense mechanisms to combat bark beetle attack, thus increasing the risk of successful bark beetle attack and mortality (Kenaley et al., 2006). Reduced tree growth and shortened life span would result in stagnation of VSS classes. Additionally, the accumulation of resin and branch deformations associated with dwarf mistletoe infection would result in increased fire hazard (Conklin, 2010).

Cumulative Effects

The Wing Mountain Analysis area lies in between two other fuels reduction projects at the base of the Kachina Peaks Wilderness, the Fort Valley Fuels Reduction project to the south, and the Hart Prairie Fuels Reduction and Forest Health project to the north. Currently, the Fort Valley and Hart Prairie Fuel Reduction projects are designed to provide a swath of treated and restored forest along the western base of the Kachina Peaks Wilderness, which would help to protect the wilderness from a large scale wildfire burning from the WUI. The acreage of the Wing Mountain project would not be a part of the swath of protection for the wilderness from wildfire started in the WUI under the no action alternative.

Under the No Action Alternative, current conditions of the forest would perpetuate: canopy cover would remain high and or increase; inter and intra species competition for limited space, water, and sunlight would continue and increase; aspen would continue to decline from competition and shade-induced mortality. Increasing density would make existing pine more susceptible to bark beetle attacks with mortality occurring at a higher rate, particularly when combined with the ongoing effects of the 2010 tornado events within the project area and elsewhere on the Forest (discussed in the Existing Conditions section).

Climate change would continue to interact with the effects of fire suppression and increased tree densities to cumulatively increase the likelihood and severity of wildfires (Westerling et al. 2006) and pest infestations such as from mountain pine beetle (Regniere and Bentz 2008). According to Regniere and Bentz (2008), "historical records from the past 100 years suggest these ecosystems have had pulse of MPB-caused mortality but not at levels currently being observed." Those untreated areas not affected by wildfire are likely to be more susceptible to bark beetle infestation resulting from the cumulative impact of a century of fire suppression and changing climatic conditions.

Alternative 2: Proposed Action
Direct and Indirect Effects

Under the Proposed Action, treatments would create openings across the forested areas to begin the process of creating an uneven age stand structure with vertical diversity. The remaining forested areas would be thinned into groups creating horizontal diversity. Thinning would also have the effect of promoting the growth of large trees and increasing the development of VSS 5 and 6 size classes over the next 20 years. Basal area, canopy cover and trees per acre would be reduced. This treatment would increase understory productivity, increase tree growth and tree health, and reduce fuel ladders. Thinning would also reduce the fire hazard within the project area, allowing for prescribed burning and naturally occurring surface fires with wanted ecological effects. Treatments within Mexican spotted owl habitats would be designed to expedite the development of nest/roost habitat characteristics.

Forest Structure

Ponderosa Pine and Mixed Conifer

Table 17 shows current and modeled post treatment conditions at the stand level for the foraging, PFA, and nest areas. Within the foraging areas[5], thinning results in increasing the percent of VSS5 from 4% to 33% post-treatment. In these VSS 3 dominated (5-12" dbh) stands, many

[5] Northern goshawk foraging habitat refers to all ponderosa pine stands outside of northern goshawk post-fledgling areas (PFAs)

VSS3 trees are being removed and almost no VSS5 trees are removed. As a result, the basal area from VSS5 trees is greater than the basal area of other VSS classes. Under the PFA, there is an increase in VSS5 and 6 and decrease in VSS3 and 4. When thinning a stand, standard policy is to favor the dominate (typically VSS 5 and 6) over co-dominate, suppressed, and intermediate trees (typically VSS3 and VSS4). As a result, a large number of stands in the PFA would shift from VSS3 and 4 to VSS5 and 6. Over time, after this treatment, the openings created would become VSS3 and 4 tree groups, and in future treatments, new openings would be created in those areas with an overabundance of VSS5 and 6 tree groups. Converting the even-aged stands to uneven-aged stands within this project area would take several treatments whose implementation would span over many decades.

Table 17 shows the modeling results of proposed action and no action after 20 years from the time of treatment. In 20 years, areas treated under the proposed action would have an increase in the percent of VSS 1, 5, and 6 tree groups. Openings created in the northern goshawk foraging (outside PFA) and PFA treatments stands would have regenerated, moving those stands towards the desired condition of uneven aged stand structure. The more open stand structure would increase tree growth and the number of large trees across the treatment areas (Fisk et al., 2006). The treated stands in the goshawk nest treatments would have moved towards the desired condition increasing the percent of VSS 5 and 6 from 17% to 34%.

Table 17: Average stand values of current conditions and post treatment conditions for northern goshawk foraging, PFA, and nest areas

	Treatment Acres	Basal Area	Canopy Cover	Trees per acre	VSS 1/2 %	VSS 3 %	VSS 4 %	VSS 5 %	VSS 6 %
Outside PFA									
No Treatment	7079	156	73	324	0	46	43	4	6
Treated		51	45	100	20	3	26	33	19
No Treatment-20 years out		170	75	259	0	25	59	11	5
Treated-20 years out		72	54	91	20	1	24	23	33
Inside PFA									
No Treatment	959	142	71	385	0	38	52	5	5
Treated		66	51	96	20	0	38	27	15
No Treatment-20 years out		157	74	318	0	14	62	19	5
Treated - 20 years out		83	57	85	20	0	30	27	23
Nest									

	Treatment Acres	Basal Area	Canopy Cover	Trees per acre	VSS 1/2 %	VSS 3 %	VSS 4 %	VSS 5 %	VSS 6 %
No Treatment	456	140	71	312	0	67	17	0	17
Treated		71	53	94	0	33	33	17	17
No Treatment-20 years out		153	73	269	0	33	50	0	17
Treated-20 years out		83	57	84	0	0	67	17	17

There are 652 acres of identified protected stands for Mexican spotted owls in the mixed conifer vegetation type. Of the protected acres, 521 acres are inside of MSO PACs and 131 acres are outside of the MSO PACs and located on the steep slopes of Wing Mountain. There is a 104 acre MSO nest stand which would not receive treatment. There are 315 acres identified as restricted MSO habitat with 82 of those acres designated for management as target threshold habitat. Treatments for target threshold habitat would follow Coconino Forest Plan guidelines for managing target threshold habitat. Ten percent of the restricted acreage has been identified for target threshold. This area will be managed for the minimum basal area of 170 square feet per acre. Fifteen percent of the restricted acreage has been identified for target threshold and will be managed for the minimum basal area of 150 square feet per acre.

Table 18 displays the pre and post treatment data and stand conditions for both alternatives projected out 20 years for stands within the MSO PACS and restricted stands outside of the MSO PACs. Treatment and management of these stands would follow the standards and guidelines of the Coconino Forest Plan.

Table 18: Average stand values for Mexican spotted owl protected, restricted, and target threshold habitat. Values displayed are for existing conditions, conditions after treatment, and stand values for treated and not treated areas projected out 20 years*

Protected Habitat	Acres	BA	CC	TPA
Existing Conditions	652	173	76	506
After Treatment	521**	148	72	166
No Treatment projected out 20 years	652	180	77	393
Treatment projected out 20 years	521**	155	73	143
Restricted Habitat				
Existing Conditions	234	161	74	650
After Treatment	234	176	76	540
No Treatment projected out 20 years	234	176	76	540
Treatment projected out 20 years	234	123	67	245
Target Threshold				

Protected Habitat	Acres	BA	CC	TPA
Existing Conditions	82	259	86	966
After Treatment	82	160	74	505
No Treatment projected out 20 years	82	247	85	695
Treatment projected out 20 years	82	182	77	473

**Assuming no wildfire occurs in the project area.*
***Number of treated acres.*

The proposed action treatments within the protected, restricted, and target threshold stands would reduce the density of pine and mixed conifer through thinning. Basal area, canopy cover and trees per acre would be reduced. Also, what the table above also demonstrates is that while density is decreased by about half, BA and canopy cover are only decreased from 10- 30%. This is important because it reduces characteristics resulting in tree mortality, pest and disease, and fire risk while maintaining characteristics important for wildlife habitat.

This treatment would increase tree growth, tree health, and reduce fuel ladders. In 20 years, basal area and percent canopy cover would still be less than existing conditions, and more importantly, more basal area would be made up of larger, older trees. Trees per acre would be less with individual trees being larger. Thinning would reduce the fire danger allowing for prescribed burning with desired ecological effects.

Aspen
The aspen treatments under the proposed action would be implemented on approximately 272 acres of pure aspen stands. Additionally, in the 1046 acres that contain small groups of aspen, these treatments may be implemented in conjunction with the primary treatment designated for that area. Aspen treatments would be secondary to the primary proposed action of that unit. For example, aspen treatments in an MSO PAC would not allow for cutting trees over 9" dbh.

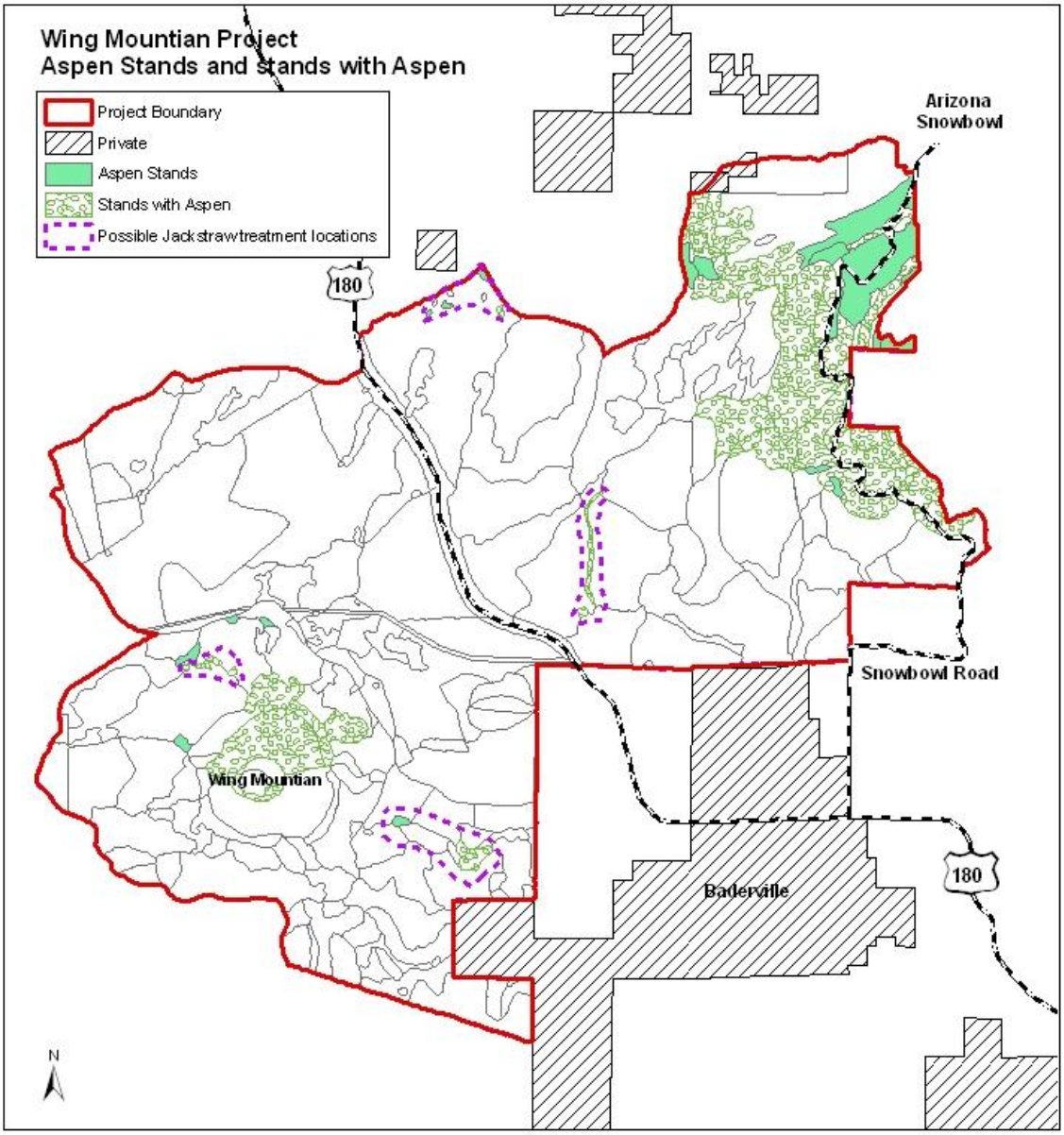
Aspen treatments would consist mainly of removing conifers from aspen stands and groups. Some aspen stands or groups may be fenced or jackstrawed to prevent large ungulate browsing and damaged to aspen regeneration. Fences would be in place for 20 to 30 years.

Jackstrawing is a treatment that has not been widely practiced on this district. Jackstrawing treatments have been recently implemented in the Hart Prairie Project and in the Schultz fire rehabilitation efforts. If those treatments are successful at deterring large ungulate browsing and the aspen is able to successfully regenerate, as determined by periodic monitoring, then this treatment would be considered as an option for treating some of the aspen stands and groups in the Wing Mountain Project. Due to concerns related to high fuel loading created by jackstrawing, the jackstrawing option would only be allowed in certain areas (Figure 5). Jackstrawing would not occur until the surrounding stands have received treatment.

Immediately after treatment, total trees per acre would also decrease, however the number of aspen per acre would remain the same (Table 16). This represents the removal of conifer encroachment from aspen clones. In 20 years, the proposed action would result in a significant increase in the basal area and a higher number of trees per acre of aspen across the aspen cover type. Both of these effects would be the result of conifer removal. Aspen clones would experience increased health, growth, and vigor due to the removal of conifer encroachment,

partial cutting or ripping, prescribed burning, and the protection of regeneration from ungulate browsing (Stam et al., 2008). Jackstrawing and fencing within aspen clones would provide protection for aspen seedlings from ungulate browsing. With increased health and vigor, aspen would be more resilient and less susceptible to disease, with increased longevity. The proposed action would result in increased biodiversity and improved wildlife habitat across the landscape. Aspen regeneration is only expected to be successful in stands and groups which are fenced or jackstrawed. Fencing and jackstrawing are not expected to be implemented on a large scale across the project. Figure 5 shows where jackstrawing would occur in the project area. Fencing is expensive and labor intensive and does not lend itself well to widespread treatment.

Figure 5: Location of aspen cover type and stands which contain aspen. Also shown is the location of possible jackstrawing treatments



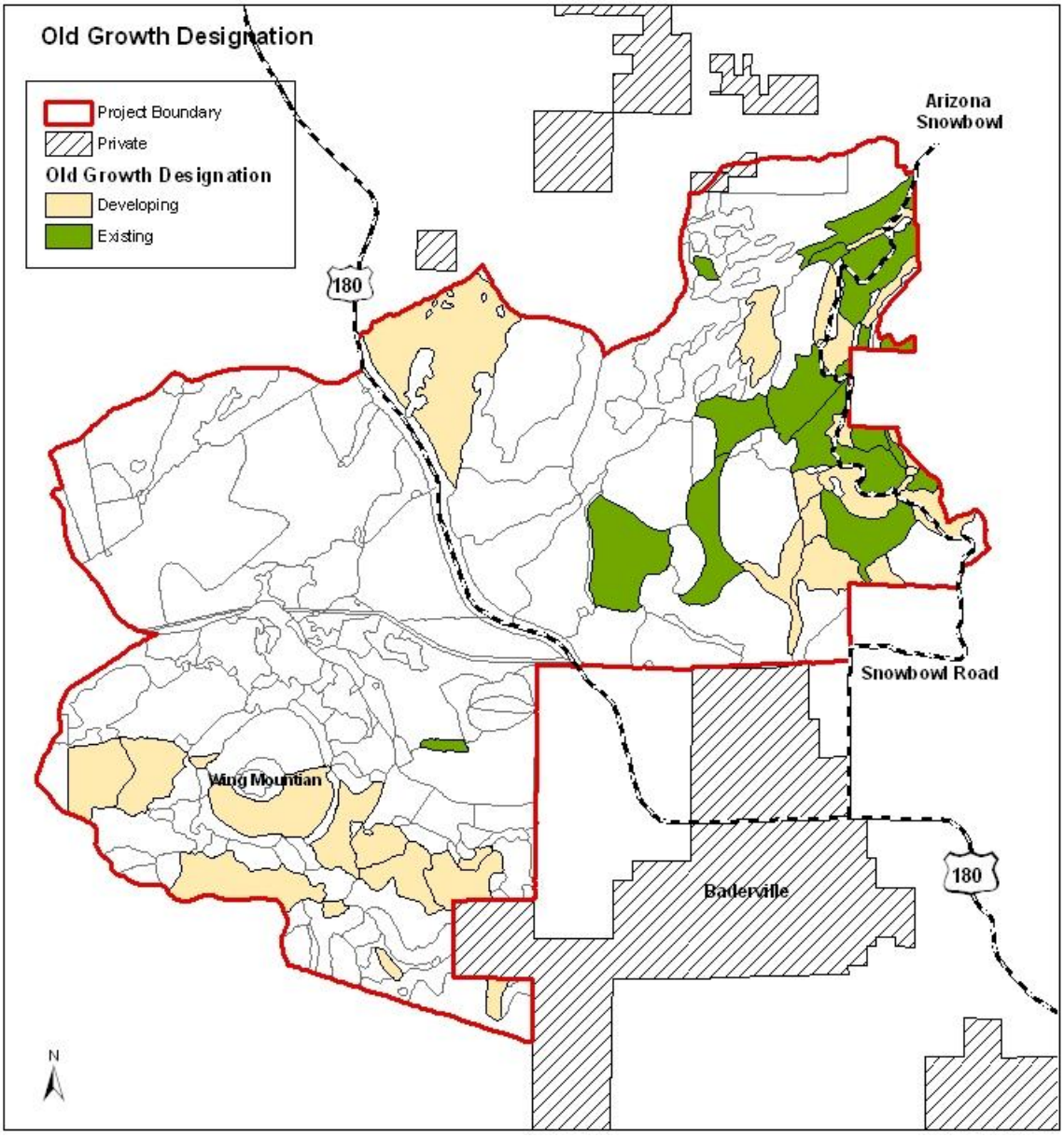
Grasslands and Meadows

The Proposed Action would reduce the number of trees within areas that were historically grassland vegetation types. Under the proposed action, mountain grasslands and pine savannahs would be restored to presettlement densities. Removal of the forest trees would reduce encroachment upon the grasslands. Slash left behind from thinning operations would create micro-sites which would help the return of grass and forbs and help with the recovery of the grasslands. Broadcast burning would help release nutrients bound up by dead fuel and help with the grassland recovery process (Grady and Hart 2006). Removal of pine encroachment would increase sunlight to meadow floor and increase forb and grass production and increase understory diversity (Grady and Hart 2006). Indirect effects of reduced densities in these areas include restoration of their functionality in terms of wildlife habitat, watershed production, fire hazard, and scenic values.

Old Growth

The proposed action would designate 1664 acres of additional developing old growth (Figure 6). All of the 2,604 acres of existing and designated old growth would receive treatments. Treatments would be designed to retain old trees and promote the growth of existing trees to become large old trees. For stands which currently meet existing old growth requirements, treatments would be designed to retain all old growth characteristics, improve the health of old trees, and reduce the fire hazard for those stands. No yellow pines of any size would be cut under this proposed action except for extenuating circumstances as outlined in the design features of the environmental assessment.

Figure 6: Existing old growth and designated developing old growth located within the project area



Forest Health
Dwarf Mistletoe and Bark Beetles

In lightly infected stands, where less than 25% of the area is infected, mistletoe would not have a huge influence on the design of the silviculture prescription. Those lightly infected stands would be thinned similar to uninfected stands. In moderate to heavy infected stands or groups, careful consideration would be made on how to treat stands and would follow the recommendations of Conklin and Fairweather (2010). It is expected that dwarf mistletoe infection levels would be

reduced slightly from current infection levels and would be relatively stable once thinning and initial burning treatments are completed.

Current stand densities within the project area provide stand conditions that favor increases in bark beetle and other insect populations. The proposed action would have an indirect effect on susceptibility to insect attack and mortality. Decreasing stand densities would reduce competition between trees, resulting in increased tree vigor. Individual trees would be better able to defend themselves against bark beetle attack (McMillin, 2008; Negron, 2009). After implementation of the proposed action, the risk of insect attack and mortality for residual trees would be greatly reduced across the project area. After the slash generated from thinning activities has been burned, the majority of the project area would be broadcast burned, further reducing the risk of mortality from bark beetles and other insects.

Cumulative Effects

The spatial boundary for this cumulative effects analysis includes the surrounding watersheds and landscape in the Flagstaff District. Reasonably foreseeable activities to occur in the next 20 years are considered for cumulative effects in this analysis.

Over the past century, several events, including fire exclusion, livestock grazing, and high-grade timber harvesting, occurred over the majority of the project area and in adjacent stands. These events resulted in disruption of the historic fire regime that consisted of frequent, low-intensity surface fires. In 1919, climatic events favored dense ponderosa pine regeneration. At this time, understory production was greatly decreased by grazing and offered little competition with pine regeneration. As fire suppression and sawlog harvesting continued through the 20th century, regeneration from 1919 continued to grow in density. In the mid- to late 1900s, commercial thinning treatments in and adjacent to the project area removed a large proportion of the mature and old trees, contributing to a more even-aged forest structure. At the same time pre-commercial thinning treatments occurred that reduced the density of younger forest, mainly through even spacing of residual trees. Although these treatments did provide some short-term improvement to forest health, vigor, and growth by reducing stand densities and increasing the growing space of individual trees, they also caused further departure from the variable, patchy tree distribution that typified the historic ponderosa pine forest structure. Additionally, blending treatments were used to produce a single age class deemed "more manageable" in terms of regulated timber harvesting. Past events have resulted in increased stand densities, decreased age and size class diversity, altered stand structure, changes in successional dynamics, altered insect and disease dynamics, decreased understory productivity and diversity, decreased tree vigor, increased fuel accumulation and continuity, increased crown fire potential, increased fire size and intensity, and a more even-aged forest structure (Long 2003).

Currently, there are two ongoing projects located adjacent and or inside the project area. The purpose of the Hart Prairie project is to reduce hazardous fuel accumulation, while improving forest health and promoting the development of VSS distributions recommended by management recommendations for the Northern goshawk. The purpose of Tornado Recovery project is to remove damaged trees and hazard fuel and to mitigate fire hazards and potential bark beetle outbreak. Two other projects adjacent to the Wing Mountain project have recently been completed. The Fort Valley and A-1 Mountain projects were both large scale restoration treatments to reduce hazardous fuel accumulation while improving forest health. One other project that is currently being undertaken is the Four Forest Restoration Project (4-FRI). 4-FRI is

a landscape scale project that would treat the majority of the accessible ponderosa pine forest across the entire district (and within three other forests) over the course of approximately 20 years. The treatments proposed for the 4-FRI project will likely be similar to the Wing Mountain and aforementioned projects.

The recently-signed decision on the Coconino Travel Management Rule (September 2011) closes a number of roads within the Wing Mountain project area. The expectations are that the restricted travel will reduce the amount of snags and down wood removed for fuelwood harvest (Wisdom, 2008) away from designated roads.

With the advent of global climate change, more frequent and higher intensity wildfires are expected (Marlon et al. 2009). Future droughts and temperature increases would also likely result in greater tree mortality from more frequent and greater intensity outbreaks of bark beetle (Van Mantgem et al. 2009 and Williams et al. 2010). This project would make the forest more resilient and thus counteract the effects of climate change.

Forest restoration treatments over the next 20 years from projects including 4FRI, Hart Prairie, A-1 Mountain, and Fort Valley projects will combine to create more open forest conditions as a landscape scale, with groups of dense trees at differing age classes. This will cumulatively result in a landscape mosaic over time resulting in more diverse forest conditions that will be more resilient to disturbance events such as climate change, wildfires, and insect infestations. A more sustainable forest structure is more resilient and capable of maintaining its health in the face of climate change and other disturbances. The proposed alternative and ongoing treatments would result in a decreased risk of insect attack and mortality at both the project and landscape levels.

Also, the risk of a crown fire of sufficient intensity to significantly alter forest structure would be reduced. Additionally, these treatments would also result in faster development of a landscape-level VSS distribution recommended for the northern goshawk by retaining large trees, creating openings for regeneration, and increasing tree growth and vigor. Increased grass and forb production would help spread and carry natural periodic surface fires. Lastly, by focusing on the removal of smaller diameter trees, this and other projects would retain and produce larger diameter trees for both ecological and social/aesthetic values.

Wildlife

The following section summarizes existing and desired conditions for threatened, endangered, and Forest Service sensitive species (TES), management indicator species (MIS), and migratory bird priority species that may occur or may have habitat within the analysis area. The analysis area is identified as the Wing Mountain project area; for the purpose of analysis of impacts to wildlife, the action area is defined as the project area plus a 0.5 mile buffer around the project area to include analysis of noise disturbance and smoke impacts. Quantity and quality of habitat are analyzed (for MIS, this is limited to the habitat type and/or component for which a particular MIS serves as an indicator), as well as physiological disturbance from project implementation. For northern goshawks, VSS distribution and canopy cover within nest areas, post-fledgling family area (PFA) and foraging areas are analyzed. For the Mexican spotted owl, the Primary Constituent Elements of Critical Habitat related to forest structure and maintenance of adequate prey species (FWS 2004) are analyzed.

Effects to species are grouped when impacts would be similar. Cumulative effects are addressed separately for Mexican spotted owl, black-footed ferret, and northern goshawk. For all other species, common cumulative effects are summarized at the end of the Wildlife section. Any species-specific cumulative impacts are included in that species' effects discussion. The Wildlife Specialist Report in the project record contains detailed descriptions of species and effects, as well as all activities considered in the cumulative effects analysis.

Threatened, Endangered and Forest Service Sensitive (TES) Wildlife Species

There are two federally listed species and 16 Region 3 Forest Service Sensitive Species that are present or have habitat within the project area (Table 19).

Table 19: TES wildlife species that are present or have habitat within the project area

Species Name	Scientific Name	Status
Birds		
Mexican spotted owl	*Strix occidentalis lucida*	Threatened
Bald eagle	*Haliaeetus leucocephalus*	FS Sensitive
Northern goshawk	*Accipiter gentilis*	FS Sensitive
American peregrine falcon	*Falco peregrinis anatum*	FS Sensitive
Western burrowing owl	*Athene cunicularia hypugaea*	FS Sensitive
Ferruginous hawk	*Buteo regalis*	FS Sensitive
Mammals		
Black-footed ferret	*Mustela nigripes*	Endangered
Navajo Mogollon vole	*Microtus mogollonensis navajo*	FS Sensitive
Long-tailed vole	*Microtis longicaudis*	FS Sensitive
Dwarf shrew	*Sorex nanus*	FS Sensitive
Merriam's shrew	*Sorex merriami*	FS Sensitive
Allen's lappet-browed bat	*Idionycteris phyllotis*	FS Sensitive
Pale Townsend's big-eared bat	*Corynorhinus townsendii pallescens*	FS Sensitive
Spotted bat	*Euderma maculatum*	FS Sensitive
Amphibians		
Northern leopard frog	*Lithobates pipiens*	FS Sensitive
Invertebrates		
Four-spotted skipperling	*Piruna polingii*	FS Sensitive
Mountain silverspot butterfly	*Speyeria nokomis nitocris*	FS Sensitive
Blue-black silverspot butterfly	*Speyeria nokomis nokomis*	FS Sensitive

Threatened and Endangered Species

Mexican Spotted Owl and Mexican Spotted Owl Critical Habitat

Affected Environment

The Mexican spotted owl (MSO) was listed as Threatened under the Endangered Species Act in 1993, and Critical Habitat was designated in 2004 (USFWS 2004). The MSO recovery unit that encompasses the Coconino National Forest is the Upper Gila Mountain Recovery Unit (USDI Fish and Wildlife Service 1995).

The Forest Plan designates several types of habitat for MSOs. *Restricted habitat* includes all riparian areas, as well as mixed conifer and ponderosa pine-oak forests with slopes <40%. All of the Restricted Habitat in the project boundary consists of pine-oak forest. The Plan calls for 25% of restricted habitat in mixed conifer to be managed for future MSO nesting and roosting habitat (USDA 1987; Table III.B in the MSO Recovery Plan for details; USDI FWS 1995). This acreage is designated as *Target Threshold habitat*. *Protected habitat* includes protected activity centers (PACs); special areas such as Wilderness and Research Natural Areas; and all mixed conifer and pine-oak forests with slopes >40%. *Protected Activity Centers (PACs*) are 600 acres in size or greater, and they surround nests and day roosts. Nest Cores/Buffers are approximately 100 acres in size or greater and they surround nests and roosts even more closely than PACs. *Critical Habitat* includes both Protected and Restricted Habitat and is designated by the U.S. Fish and Wildlife Service for the survival and recovery of listed species. Critical habitat in the project area lies within the Upper Gila Mountains (UGM) Recovery Unit 14 (USDI FWS 1995). Table 20 displays the different habitat designations and their corresponding acreages found within the project area.

Table 20: Acres of MSO habitat within the project area, by habitat type

Habitat Type	Acres
Critical Habitat	2,471
Protected Habitat	652
Protected Habitat in PACs	521
PAC Habitat in Nest Cores	104
Restricted Habitat	234
Restricted Habitat Managed for Target/Threshold	82

Approximately 35% of the project area is rated as having an extreme fire hazard, and 94% of the project area is in Fire Regime I, Condition Class Level 3, indicating that wildfire activity would result in more severe effects to ecosystem components than should occur for the natural fire regime. Table 21 displays the fire hazard, fire regime, and condition classes for protected and restricted habitat within the project area. The majority of protected and restricted habitat has extreme to high fire hazard whereas all of protected and restricted habitat within the project area consists of vegetative characteristics (i.e. forest structure and composition) that deviate largely

from historic reference conditions, increasing the risk for a stand replacing fire to take place within these areas especially when fuel and weather conditions are favorable for such fire activity.

Table 21: Fire Hazard, Regime, and Condition Class in Protected and Restricted Habitat within the Wing Mountain Project Area

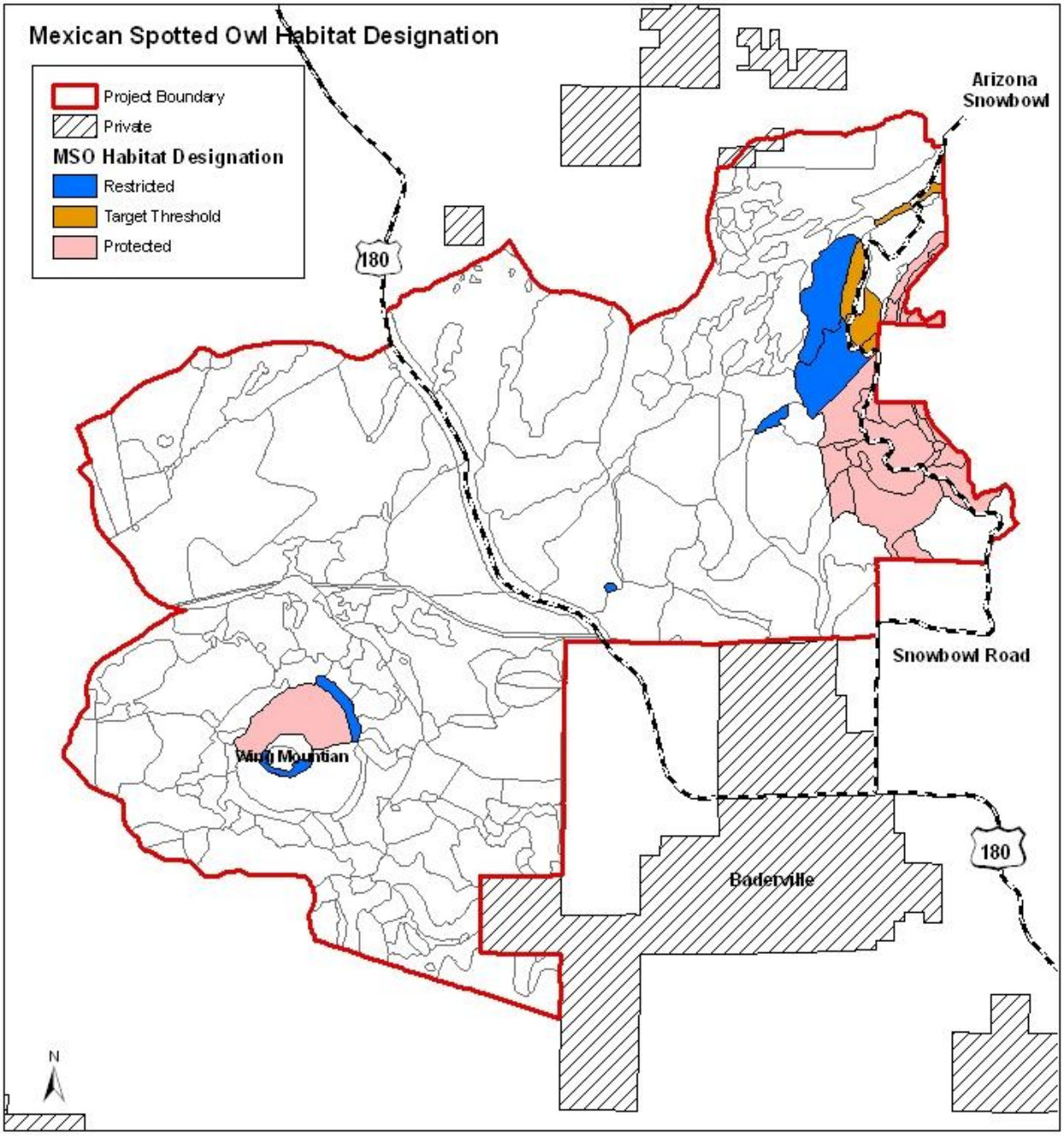
Habitat	Acres and % of Total in Project Area					% in Fire Regime I, Condition Class Level 3
	Extreme	Very High	High	Moderate	Low	
Snowbowl Road PAC	323 (69%)	0	145(31%)	0	0	468 (100%)
Viet Springs PAC	34(66%)	7 (11%)	0	3 (5%)	9 (18%)	53(100%)
Other Protected Habitat	131 (100%)	0	0	0	0	131 (100%)
Restricted Habitat	222 (92%)	12 (5%)	0	0	0	234 (100%)

Two PACs, Snowbowl Road PAC (approximately 468 acres) and Viet Springs PAC (approximately 53 acres) exist within the Wing Mountain project area. Mexican spotted owl detections have occurred in the Snowbowl PAC in 17 out of 24 years and two detections in 15 years have occurred in the Viet Springs PAC. Figure 7 displays MSO habitat within the project area.

The highly used Forest Road (FR) 516 (Snowbowl Road) travels through the Snowbowl Road PAC and within 1,000 feet of the Viet Springs PAC for about one mile, making both PACs easily accessible from the road. Historic roost and nest sites are located on both sides of FR 516. The Viet Springs Trail, a popular hiking trail that experiences heavy use in the fall, travels through both PACs and is immediately adjacent to a roost site used in 2002 and a nest site used in 1999. This trail occurs on the Lamar Haines special use area maintained by AZGFD. The area within and around the PACs is a popular recreation destination for hikers, mountain bikers, recreational drivers, and others. Given the traffic on Snowbowl Road, the proximity of the Viet Springs hiking trail, and the frequent recreational use of the area, the owls that occupy these PACs have displayed at least some level of tolerance for human activities, as evidenced by their continued occupancy of the area.

The purpose of restricted habitat is to maintain and create replacement owl habitat, while providing a diversity of stand conditions and sizes across the landscape. Existing conditions of restricted habitat within the project area do not provide for replacement owl nest/roost habitat because they do not lend to the recruitment of old-growth trees, and therefore, large snags and downed logs. Furthermore, restricted habitat within the project area consists of a dense overstory that prevents the development of a structurally and biologically diverse assemblage of tree and understory species to support a wide variety of prey species.

Figure 7: MSO Habitat within the project area



Environmental Consequences

Alternative 1: No Action
Direct and Indirect Effects

Under the No Action there would be no direct effects to Mexican spotted owl. However, this alternative would not help improve habitat conditions or reduce the risk of stand replacing wildfire. Unnaturally dense forest conditions would maintain the current high risk of stand replacing wildfire. Stand replacing fire would degrade or destroy mature forests, large trees, and snags on which this species relies. Even if a stand replacing fire did not occur, tree densities would continue to be high, resulting in a slower maturation into larger diameter trees which are important to the existence and survival of MSO. Unnaturally dense forest conditions would also increase the probability of insect and disease outbreaks (Fettig et al. 2007).

Cumulative Effects

The No Action Alternative would contribute to the current risk of stand replacing wildfire that threatens Mexican spotted owl habitat. Fire hazard would continue to increase over time as vegetation would continue to grow and fuel would continue to accumulate without treatment. Severe wildfires, such as the Schultz Fire which burned through several PACs, can result in a reduction of habitat for MSO and also a reduction of MSO recruitment. A high-severity wildfire in this area would likely result in similar effect, resulting in a cumulative impact to owl population growth on this part of the Forest.

This alternative would cumulatively increase the number of acres on the National Forest that are vulnerable to severe fire effects, thereby contributing to a cumulatively negative effect to MSO. Recreation (e.g., hiking, biking, and camping) may disturb owls. Recreational activities would continue to occur in the project area, resulting in a potential decrease in fitness for owls. Insect and disease outbreaks have killed and will continue to kill trees. The No Action Alternative coupled with insect- and disease-related mortality would favor the creation of more snags which would be a beneficial cumulative effect for MSO habitat and consequently MSO. However, despite this beneficial effect, the no action alternative may have an adverse effect on MSO due to the multiple non beneficial cumulative effects of the No Action Alternative to MSO and its habitat.

Alternative 2: Proposed Action
Direct and Indirect Effects

Table 18 in the Forest Vegetation and Health section displays existing conditions and average post treatment stand values for stand density and canopy cover. Additionally, design features and mitigations listed in Chapter 2 would be followed and adhered to during treatment implementation.

Approximately 417 acres of PACs (89%) would be thinned up to 9 inches and prescribed burned initially and then again every 3 to 7 years, subsequently referred to as periodic prescribed burning. Twenty five acres within PACs also would receive aspen restoration treatment in addition to MSO treatment because patches of aspen occur within these acres. Aspen restoration would include a variety of treatments to either induce root suckering of aspen and/or to protect aspen regeneration from severe ungulate browsing. No treatments would occur in the 104 acre nest core. Approximately 131 acres of protected habitat outside of the PACs occur on Wing Mountain and would be burn only treatments due to this habitat occurring on steep slopes, thereby being infeasible to treat with mechanical thinning. Protected habitat would be surveyed according to protocol standards prior to implementation. Fuels-reduction activities, temporary

road construction, and other forms of disturbance would not occur during the breeding season. Additionally, "daylighting" would occur along approximately 0.6 miles of FS Road 516 in protected habitat. The focus of "daylighting" would be to increase the amount of sunlight reaching the road to maximize exposure for melting snow and ice while maintaining natural forested views. In the portions of this treatment that would occur within a MSO PAC, thinning would be limited to trees 9 inches dbh and below.

Approximately 212 acres of Restricted Habitat would be primarily hand thinned up to 9 inches in diameter and periodically prescribed burned. Approximately 12 acres would be prescribed burned only due to steep slopes making mechanical and hand thinning impractical to perform. Approximately 9 acres would receive mixed conifer restoration treatment which includes thinning and burning in mixed conifer stands.

Approximately 82 acres of Target Threshold Habitat, a subset of Restricted Habitat, would receive thinning and prescribed burning treatments. This acreage was identified as Target Threshold Habitat because it is adjacent to PACs and has the highest potential to develop into MSO nesting and roosting habitat. Target/Threshold habitat would move toward favorable conditions for owls, with a high basal area dominated by a greater proportion of large trees.

Broadcast burning could potentially affect MSO critical habitat by: 1) torching small patches of trees, 2) decreasing dead and down biomass and snags (Randall-Parker and Miller 2002), and /or 3) stimulating herbaceous vegetation growth, thereby increasing forage and hiding cover for the small mammal prey base (Kalies and Chambers 2010). Small group torching would mimic gap processes that occur under natural conditions and therefore would have a negligible effect on MSO critical habitat. A decrease in woody biomass and snags could cause a decrease in Mexican spotted owl prey species but this decrease would be short term (approximately 3 to 5 years) because downed woody material would continue to be deposited on the forest floor, trees would continue to die creating snags and logs, and herbaceous vegetation would be expected to respond favorably to thinning and burning treatment (Moore et al. 2006), conditions all of which are essential to the existence and maintenance of small mammal prey base.

Project activities would not occur within either PAC during the breeding season and for this reason would have a negligible direct effect on Mexican spotted owl. Also, project activities would not occur within a half-mile of the PAC boundaries during breeding season if they are active. Activity would be determined by surveys prior to implementation. If surveys are not conducted, it would be assumed that the PACs are occupied and no project activities would occur until the end of the breeding season.

Because thinning within PACs would be conducted outside the breeding season and would be limited to thinning trees less than 9 inches in diameter, there would be no disturbance to nesting owls or loss of nest or roost sites.

Smoke from prescribed burning could disturb owls but would be of short duration (up to approximately 3 to 5 days). Smoke accumulation could cause owls to temporarily flush from roost sites. Mexican spotted owls are known to return to PACs after fire and smoke have ceased (USFWS 2011). Short term smoke impacts would be reduced by coordinating the timing of burning with favorable conditions such as wind direction and time of year (see the Wildlife Design Features listed in Chapter 2).

Prescribed burning could indirectly affect Mexican spotted owl by changing habitat structure for prey species by reducing downed woody material and potentially snags. The reduction in these important habitat features could reduce the abundance of prey species. The reductions in prey species would likely be of short duration. Jenness (2000) found that broadcast burning decreases prey base abundance for approximately one year. Herbaceous vegetation typically responds favorably to broadcast burning after thinning resulting in favorable conditions for Mexican spotted owl prey.

Cumulative Effects

The cumulative effects were analyzed for the project area in addition to a ½ mile buffer outside the project area. Actions included in this analysis are those likely to occur over the next 20 years. Effects were analyzed based on the likelihood of project activities impacting owls within the project area. Potential cumulative effects include smoke impacts, thinning treatments, cattle grazing, and recreation activities.

As a result of this proposed action and other similar actions from adjacent forest health projects (Fort Valley, Hart Prairie, and Forests Restoration Initiative Fuels Reduction and Forest Health Restoration Projects) prey species diversity would increase with increased diversity of vegetation structural stages and improvement of understory vegetation. Over time, a more diverse prey base would enable different prey species to prosper during variable climatic conditions, thus improving food availability. In addition, vegetation treatments in the adjacent projects (listed above) would help improve tree vigor and growth, and vegetative structural stage diversity, thus promoting the growth of larger trees and habitat components for Mexican spotted owl. Cumulatively, this project and other similar projects in the area would have the effect of partially counteracting the effects of climate change by making the forest more resilient to drought and high temperatures, and by reducing the risk of severe wildfire occurrence (Joyce et al, 2009; Spittlehouse and Stewart, 2003).

Burning in the vicinity of PACs during the breeding season would be conducted in a manner that would minimize smoke impacts to Mexican spotted owl. It is anticipated that burning activities on portions of the Wing Mountain project area could occur simultaneously with burning activities of other projects. However, ADEQ standards limit the total amount of burning allowed in the airshed at a given time. Thus, cumulative impacts from smoke to PACs as a result of prescribed burning on multiple projects would continue to be limited.

Livestock grazing has occurred in all or most of the cumulative effects analysis area at some time or another since the 1870s. Livestock grazing currently occurs west of the project area on most of the Kaibab National Forest and south, east, and north on the Coconino National Forest and on state and private lands. Grazing could affect Mexican spotted owl prey base by reducing herbaceous vegetation that prey species rely on for forage and cover. However the portion of the project area that is within the Peaks Grazing Allotment (2,391 acres) has been deferred from grazing for the past 15 years and will continue to be deferred as a result of the August 19, 2010 Decision Notice for the Peaks Grazing Allotment EA. Thus there would be no cumulative effects from grazing on Mexican spotted owls or their habitat.

Human recreational activities can affect the fitness of owls by affecting the nesting, roosting, foraging, and general movement of Mexican spotted owls. A reasonably-foreseeable project

whose area would overlap that of the Wing Mountain project area is the Highway 180 Motorized Trails project, which would designate a motorized-trail system on both sides of Highway 180, including near Wing Mountain. This project is unlikely to include designating trails within MSO PACs, and would likely concentrate motorcycle/OHV traffic away from sensitive wildlife habitat. Thus, there would be no cumulative impacts from increased motorized recreation to Mexican spotted owls in or near the project area.

The Coconino National Forest has recently finished the process of analyzing road closures under the Travel Management Rule. A significant number of roads have been closed to motorized vehicles, including routes such as 9130P, 9215F, 9008U, which those located within MSO PACs. Road closures will likely reduce recreational disturbance to wildlife. Thus, this project would result in a cumulative decrease of disturbance to owl in the long-term (10-20 years).

Black-Footed Ferret

Affected Environment

Black-footed ferrets are not known to occur in the project area although potential habitat exists within the Wing Mountain project area. Black-footed ferrets occupy prairie dog burrows and utilize prairie dogs as a main food source. Thus, undiscovered wild populations of black-footed ferrets may still exist where prairie dogs persist (USDI Fish and Wildlife Service 1998).

Black-footed ferret surveys have not been conducted in the project area. However, it is unlikely that ferrets occur in the project area due to existing prairie dog towns within the project area being relatively small. Ferrets historically occupied meadows and grasslands that of which have been reduced in the project area due to years of fire suppression and subsequent conifer encroachment. Other factors that have affected the size of prairie dog colonies yearly and therefore any potentially existing black-footed ferret populations have been occurrences of sylvatic plague, predation by coyotes, raptors, badgers, and bobcats, and legal shooting. Reintroduced populations in northern Arizona occur in Aubrey Valley approximately 70 miles west of the project area and on the Espee Ranch approximately 50 miles northwest of the project area.

Environmental Consequences

Alternative 1: No Action
Direct and Indirect Effects

Under the No Action Alternative, there would be no direct effects to black-footed ferret. Indirect effects to black-footed ferrets include effects to potential ferret habitat, prey species habitat, and prey species populations. Under the No Action Alternative, trees would continue to encroach upon meadow and grasslands reducing and degrading habitat for prairie dogs.

Cumulative Effects

Under the No Action Alternative the current risk to black-footed ferret habitat would remain. There would continue to be a reduction of grassland acres within the National Forest. The fire hazard would increase over time as conifers continue to encroach, thereby increasing the already

high fuel load. The No Action Alternative would continue to have adverse effects to black-footed ferret.

Alternative 2: Proposed Action
Direct and Indirect Effects

There would be no direct effects to black-footed ferret or prairie dogs because treatments would not occur within occupied prairie dog colonies. Indirect effects would be effects to potential ferret habitat and prey species habitat. Under the Proposed Action, 619 acres of meadow restoration and 173 acres of grassland with pine savannah would be restored thereby increasing available habitat for prairie dogs, a primary prey species, resulting in indirect beneficial effects.

Cumulative Effects

The cumulative effects area analyzed is the project area and a 0.5 mile buffer. Potential cumulative effects to black-footed ferret include trails and roads that provide access to prairie dog towns.

Ongoing projects adjacent to the Wing Mountain project area include the Fort Valley and Hart Prairie Fuels Reduction and Forest Health Restoration Projects, and the Four Forests Restoration Initiative (4FRI). These projects also include meadow and/or grassland restoration treatments and treatments to reduce wildfire risk, resulting in a cumulative beneficial effect to black footed ferret habitat when combined with the Wing Mountain proposed action.

A reasonably-foreseeable project that would overlap the Wing Mt. project area is the Highway 180 Motorized Trails project, which would designate a motorized-trail system on both sides of Highway 180, including near Wing Mountain. This project is unlikely to include designating trails within Prairie dog towns, and would likely concentrate motorcycle/OHV traffic away from sensitive wildlife habitat. Recent implementation of the travel management rule has reduced the total miles of forest roads and is expected to reduce the amount of off road use.

Forest Service Sensitive Species

Forest Service Sensitive Species that may have suitable foraging and/or nesting/roosting habitat but are not known to occur within the Wing Mountain project area include: American Peregrine Falcon, Western Burrowing Owl, Ferruginous Hawk, Dwarf Shrew, Merriam's Shrew, Navajo Mogollon Vole, Long-tailed Vole, Townsend's Big-eared Bat, Spotted Bat, Four-spotted skipperling, Mountain Silverspot Butterfly, and Blue-black Silverspot Butterfly. Effects to these species are summarized together.

All Forest Service Sensitive Species that are known to occur within the project area are analyzed separately below (northern goshawk and Allen's lappet-browed bat). Though there are no documented occupancies within the project area, the analysis for northern leopard frogs is included separately as well due to public comments received during the scoping period. Similarly, bald and golden eagles are analyzed separately in this section as AZGFD has identified the Highway 180 corridor as a winter concentration area.

Northern Goshawk

Affected Environment

The goshawk guidelines were added as an amendment to the Coconino National Forest Plan on June 8, 2006 through a Record of Decision to amend Forest Plans in Arizona and New Mexico. This decision was based upon a rigorous study on the potential impacts of changes to the Forest Plans (including implementation of the Goshawk Guidelines) in an Environmental Impact Statement.

Northern goshawk generally prefers stands with intermediate to high canopy cover, having late successional stage characteristics, and on cool, moist aspects and/or in drainages for nesting and more open areas for foraging.

A post-fledgling family area (PFA) is defined in the Forest Plan as an approximately 600-acre area that includes a nest site and habitat that would most likely be used by fledglings during their early development. PFAs are mapped by wildlife biologists and typically surround known or historic nest sites. Four northern goshawk territories (PFAs) occur within or intersect the project area. All potential nesting and foraging habitat in the project area was surveyed for northern goshawks in 2008 and 2009 according to Region 3 protocol. Prior to the surveys, two PFAs (Pearson and Viet) occurred in the project area. The discovery of a new occupied nest with an adult pair and one juvenile during 2009 surveys prompted reconfiguration of the Pearson PFA boundary and the addition of two new PFAs. To better reflect the spatial configuration of all observations since 1982, the Pearson PFA was reduced in size, and two additional PFAs (Wing East and Wing West) were delineated.

Summaries of the effects of modeled silvicultural treatments performed outside and within PFAs and within nest areas are provided in the Forest Vegetation section in this chapter. Table 22 and in Table 23 provide existing and desired stand conditions for northern goshawk habitat.

Table 22: Average Distribution of VSS within goshawk habitat in the project area, under the desired future condition, existing condition, and action alternatives

	Habitat Type	VSS 1 & 2	VSS 3	VSS 4	VSS 5	VSS 6
Desired Future Condition	Foraging (outside PFA)	10% & 10%	20%	20%	20%	20%
	PFA (Outside of Nesting Areas)	10% & 10%	20%	20%	20%	20%
	Nesting Areas	0%	0%	0%	100%	
Existing Condition	Foraging (outside PFA)	0	46	43	4	6
	PFA (Outside of Nesting Areas)	0	38	52	5	5
	Nesting Areas	0	67	17	0	17
1 Yr. Post-Treatment	Foraging (outside PFA)	20	3	26	33	19
	PFA (Outside of Nesting Areas)	20	0	38	27	15
	Nesting Areas	0	33	33	17	17
20 Yrs. Post-Treatment	Foraging (outside PFA)	20	1	24	23	33
	PFA (Outside of Nesting Areas)	20	0	30	27	23

	Nesting Areas	0	0	67	17	17
20 Yrs., No Action	Foraging (outside PFA)	0	25	59	11	5
	PFA (Outside of Nesting Areas)	0	14	62	19	5
	Nesting Areas	0	33	50	0	17

Table 23: Proportion of Vegetative Structural Stages (VSS) and associated canopy cover values for the desired future condition, existing condition and the Proposed Action

COVER TYPE		Percent Cover*
PONDEROSA PINE Outside PFA	DESIRED FUTURE CONDITION	40%+
	EXISTING CONDITION	71%
	PROPOSED ACTION	51%
PONDEROSA PINE Inside PFA	DESIRED FUTURE CONDITION	1/3 60%+ 2/3 50%+ in VSS 4, 50% elsewhere
	EXISTING CONDITION	71%
	PROPOSED ACTION	53%
PONDEROSA PINE Inside Nesting Area	DESIRED FUTURE CONDITION	50-70%
	EXISTING CONDITION	70%
	PROPOSED ACTION	53%

*Canopy cover measures here are averaged across a stand, and are estimated for immediately after treatment implementation. Canopy cover is likely to increase over time once treatment is complete.

Northern goshawk standards and guidelines outlined in the CNF LMP apply to forested and woodland areas outside of MSO protected and restricted areas. This makes up approximately 9,196 acres of ponderosa pine stands within the Wing Mountain project area. There are no woodland areas within the project boundary.

The existing forest conditions of dense, small-diameter, young ponderosa pine trees within and adjacent to the PFAs pose an increased risk of high intensity (most likely stand replacement) fire in northern goshawk habitat. These conditions also promote risk of disease, inhibit recruitment of important northern goshawk habitat features such as old-growth trees and large snags, and restrict the conditions necessary to support a variety of prey species for northern goshawks.

Environmental Consequences

Alternative 1: No Action
Direct and Indirect Effects

The No Action Alternative would have no direct effects on northern goshawk. However, because unnaturally dense forest conditions would persist, there would continue to be a high risk of stand replacing wildfire to occur. Stand replacing fire would result in a long-term decrease in the quantity and quality of goshawk habitat. Replacement habitat would not develop for at least 100 years after a stand replacing fire.

The unnaturally dense forest conditions within the project area have an increased susceptibility to disease and insects compared to the more natural forest conditions that occurred prior to European settlement (Covington and More 1994). Insect and disease would be a detriment to suitable nesting habitats by potentially reducing canopy cover beyond what is preferable for goshawk. Stands with high a level of insect and disease activity would deteriorate, therefore not developing into future nesting habitat.

Additionally, unnaturally dense forest conditions can also affect the availability of abundant, sustainable prey populations.

Cumulative Effects

The cumulative effects boundary is defined for this analysis as the project area plus a 0.5 mile buffer, and includes potential projects for the next 20 years. Several past, present, and reasonably foreseeable actions and events have contributed, are contributing, and will contribute to the fitness of goshawks on the Coconino National Forest:

- A loss of large, old trees occurred on slopes less than 40%, due to logging during the early stages of Forest Plan implementation (late 1980s and early 1990s).
- The forest is far removed from the historical fire regime (see Fuels and Fire section). The Forest Service excluded fire from the Coconino National Forest throughout much of the twentieth century, causing mixed conifer, ponderosa pine, and other forests to grow unnaturally dense. Fire exclusion has increased the potential for high-severity wildfires, which could cause direct mortality of goshawks, and a long-term loss of microhabitat (e.g., large trees).
- Recreation (e.g., off-road vehicle use, hiking, biking, and camping) may disturb goshawks. Recreational activities would continue to occur in the project area, resulting in a potential decrease in fitness.
- Insect and disease outbreaks have killed and will continue to kill trees. Insect- and disease-related mortality creates more snags, which would have a beneficial effect in enhancing existing northern goshawk habitat.
- Climate change is expected to increase the risk of high-intensity wildfires (Marlon et al. 2009) and result in higher temperatures and more prolonged droughts, which are likely to result in mortality of larger trees (Van Mantgem et al. 2009)

The No Action Alternative would perpetuate the unnaturally dense conditions in the coniferous forests of the project area. This increase in unnaturally dense conditions would combine with increasing risk of high intensity wildfire and risk of increased tree mortality to result in a much higher likelihood of a decline in goshawk habitat across the project area and surrounding ponderosa pine and mixed conifer forest. The No Action Alternative may therefore have an adverse effect on northern goshawks.

Alternative 2: Proposed Action
Direct and Indirect Effects

Foraging areas
Under the Proposed Action, uneven-aged management methods would be used to promote regeneration and a more uneven-aged forest structure. There would be an emphasis on retaining old, pre-settlement trees. Tree groups would vary in shape, size, density and number. There would be approximately 2-40 trees per group, up to 0.7 acres in size with a basal area of 50 sq. ft.

per acre or greater in VSS 4-6. Trees in the VSS 4-6 class would make up 78% of trees and canopy cover would average 45% after treatment.

Post-Fledging Family Areas

Under the Proposed Action, uneven aged management methods would be used to promote regeneration and a more uneven aged "clumpy-groupy" forest structure. There would be an emphasis on retaining old, pre-settlement trees. Tree groups would vary in shape, size, density and number. There would be approximately 2-40 trees per group, up to 0.7 acres in size with a basal area of 70 sq. ft. per acre or greater in VSS 4-6. Trees in VSS 4-6 would make up 80% of trees after treatment. Tree groups in VSS4 would average 1/3 60% and 2/3 50% canopy cover. Tree groups in VSS5 and 6 would average 50% canopy cover.

Approximately 246 acres of the Viet PFA intersects with the Snowbowl PAC. All treatments would defer to Mexican spotted owl treatments for protected habitat. Treatments would be thinning conifers up to 9" in. and prescribed burning. Canopy cover in this area would be approximately 72% after treatments.

Nest areas

Nest stands would be thinned from below to promote old aged forest with high canopy cover. Treatments would be designed to retain and promote large trees. No openings would be created. Nest areas would have a basal area of 50-70 sq. ft. or greater per acre across stands with a higher density in VSS 5-6. Trees in VSS 4-6 would make up 69% of trees immediately after treatment. Canopy cover would be 53% or greater across the 4 nest areas.

Mechanical harvest activities would be restricted near active nests to the period outside of the goshawk breeding season to reduce the risk of disturbance to breeding goshawks. Therefore, noise from mechanical treatments would not likely directly affect nesting goshawks.

Thinning and burning treatments within stands designated as goshawk PFA under the Proposed Action would result in more open stand structures and increases in the growth of grasses, forbs, and shrubs. Increases in understory vegetation would result in increased forage and cover for certain goshawk small mammal prey species such as cottontails, ground squirrels, and chipmunks. Wildlife responses to forest treatments vary widely; generally, it is assumed that treatments which restore conditions consistent with those they have experienced over evolutionary time would have beneficial effects. Thinning and burning treatments are an effort to return forest structure and composition to within the range of natural variability, which should benefit native wildlife species (Kalies et al. 2010).

Woody debris, logs, and snags provide habitat for small mammals and other prey. There is a risk of losing some logs and snags during prescribed burning activities. Mitigation measures, including lining snags would minimize the loss of these landscape features. Additionally, it is likely that new snags and logs would be recruited during prescribed burning.
Prescribed fire objectives within all stands of the project area would be for low to moderate intensity ground fires. Prescribed burning would likely decrease the abundance of prey species in burned areas for approximately one year (Jenness 2000).

Smoke from prescribed burning could disturb individual birds, but would be short in duration (3 to 5 days).

Impacts from smoke are reduced by the coordination of timing and type of burning with wind direction, topography, and time of year.

Though a study performed in 2008 by Beier et al. indicates that "production of fledglings decreases as the breeding area's similarity to the goshawk guidelines increased," this research reflects personal observational studies or hypotheses regarding potential negative effects of the goshawk guidelines. Though the Baeier study may be useful for considering the application of the goshawk guidelines in the context of the larger body of goshawk management scientific research, it is one study based on a small sample size and is observational rather than experimental in approach, and so in and of itself it does not provide adequate information to not apply these guidelines to the Wing Mountain project. The paper itself discusses limitations of the research, as it cites two other studies that found different results (Joy 2002, Patla 1997); and states, "The low correlations we observed may be related to the fact that our circular areas did not necessarily correspond to areas of most intense goshawk use." The paper also states, "…our most productive breeding areas may have reflected qualities of the breeding pairs rather than forest structure within the breeding area." Additionally, the Beier study specifically recognized that the research results should not be generalized without additional consideration by stating, "…we caution against extrapolating our results to the effects of large-area restoration treatments."

The Proposed Action would meet Coconino National Forest Land Management Plan guidelines. Post-treatment conditions would maintain groups and clumps of trees with variable canopy cover to allow for wildlife and prey species habitat and understory diversity. Openings would be scattered throughout the PFAs and foraging areas and would not be greater than 2 acres in PFAs and 4 acres in foraging areas, and would include one group of reserve trees per acre of 3 to 5 trees per group for openings greater than 1 acre in size per the Forest Plan (p. 65-10). Although the desired future condition would not be met immediately after implementation, the forest structure would be such that it would be moving towards it.

The proposed project is expect to improve goshawk nesting habitat, improving prey abundance, and decreasing long-term risk of loss and degradation of habitat. As a result, this alternative would support increased goshawk survival and reproduction over the long-term (1-20 years after implementation of the project).

Cumulative Effects

Several past, ongoing, and reasonably foreseeable actions and events have contributed, are contributing, and will contribute to the fitness of goshawks in the cumulative effects analysis area. The cumulative effects area analyzed is the project area and a 0.5 mile buffer. Effects were analyzed based on the likelihood of project activities impacting goshawks within the project area. Potential cumulative effects include smoke impacts and thinning treatments, cattle grazing and recreation activities.

As a result of this project combined with other similar projects in the area (including the Fort Valley and Hart Prairie Fuels Reduction and Forest Health Restoration Projects and the Four Forests Restoration Initiative), prey species diversity would increase with increased diversity of vegetation structural stages and improvement of understory vegetation. Over time, a more diverse prey base would enable different prey species to prosper during variable climatic conditions, thus improving food availability. In addition, vegetation treatments in the adjacent projects would help improve tree vigor and growth, and vegetative structural stage diversity, thus promoting the

growth of larger trees and habitat components for northern goshawk and certain prey species. Cumulatively, this project and other similar projects in the area would have the effect of partially counteracting the effects of climate change by making the forest more resilient to drought and high temperatures, and by reducing the risk of severe wildfire occurrence (Joyce et al, 2009; Spittlehouse and Stewart, 2003). When combined with other adjacent project activities, the Wing Mountain project's activities would have an effect of improving long-term reproduction and overall range of the northern goshawk.

Burning in the vicinity of PFAs during the breeding season would be conducted in a manner that would minimize smoke impacts to northern goshawk. However, it is anticipated that burning activities on portions of the Wing Mountain project area could occur simultaneously with burning activities of other projects. However, ADEQ standards limit the total amount of burning allowed in the airshed at a given time. Thus, smoke impacts to PFAs are limited. Forest Plan standards also limit the amount of acres that can be burned in PFAs to one half of a PFA in any one year. Thus, there would be no cumulative impacts from smoke as a result of this alternative.

Cattle grazing has occurred in all or most of the cumulative effects analysis at some time or another since the 1870s. At that time cattle numbers were many times higher than they are currently. Livestock grazing currently occurs west of the project area on most of the Kaibab National Forest and south, east, and north on the Coconino National Forest and state and private lands. Grazing could affect northern goshawk prey base by reducing herbaceous vegetation that prey species rely on for forage and cover. However the portion of the project area that is within the Peaks Grazing Allotment (2,391 acres) has been deferred from grazing for the past 15 years and will continue to be deferred as a result of the August 19, 2010 Decision Notice for the Peaks Grazing Allotment EA. Thus, there would be no cumulative effects on herbaceous vegetation within the analysis area from grazing.

Human recreational activities can affect nesting, roosting, foraging, and general movement of northern goshawks. A reasonably-foreseeable project that would overlap the Wing Mountain project area is the Highway 180 Motorized Trails project. This project is unlikely to include designating trails within goshawk PFAs, and would likely concentrate motorcycle/OHV traffic away from sensitive wildlife habitat. The Coconino National Forest has recently finished the process analyzing road closures under the Travel Management Rule. A significant number of roads have been closed to motorized vehicles, including a number of roads occurring in PFAs such as 766, 9230R, 9230F, 9228A, 9006L, 9233Q, 9233R, and 9009K. These road closures will likely reduce recreational disturbance to goshawks and will combine with long-term reduction in the risk of high-intensity wildfire to cumulatively protect goshawk habitat from degradation.

Allen's Lappet-Browed Bat

Affected Environment

The AGFD Heritage Data Management System (HDMS) distribution map (AGFD 2006) indicates that Allen's lappet-browed bat occurs within the project area. Allen's lappet-browed bats typically roost in spaces under exfoliating bark of ponderosa pine snags averaging at least 26 inches dbh (Rabe et al. 1998).

In order to maintain a population, tree-roosting bats may require a snag density of greater than 5.2 - 6.5 snags/ha (2.1 – 2.6 snags/acre) where snags are in early decompositional stages with loose bark (Rabe et al. 1998). Large-diameter trees (26 dbh") are currently scarce (19% of ponderosa

pine forests within VSS 5 or 6) within the project area, and competition between small trees in excessively dense stands reduces the potential for large trees to become established. Allen's lappet-browed bat also uses caves for roosting. The closest known caves to the project area are approximately three miles away, and several caves are within 10 miles of the project area to the northwest, south, and southeast. The project area has not been specifically surveyed for caves, and no caves have been documented in the project area. Allen's lappet-browed bat relies mainly on moths for foraging, but the species also preys upon a variety of other insect species(AGFD 2002a, AGFD 2003, AGFD 2001).

Environmental Consequences

Alternative 1: No Action
Direct and Indirect Effects

Forests would continue to be dense and would hinder the development of ponderosa pine trees into mature, large trees needed to eventually develop into large snags. The high risk for stand replacing fire in and around the project area would still exist. This risk would indirectly affect individual roosting bats as their habitat could be destroyed if a stand replacing fire occurred within the project area. This affect would be more pronounced over the long-term as snags with bark would decay and/or fall within approximately 3-20 years (Passavoy and Fulé 2006) and there would be very few remaining trees to provide for roosting bats in the decades following.

Alternative 2: Proposed Action
Direct and Indirect Effects

Thinning and broadcast burning activities could potentially disturb bats if they are roosting in snags within the project area. Prescribed burning could also result in the loss of snags which could potentially affect roosting bats; however mitigations including protecting snags 18" dbh and greater prior would reduce the impact (see Design Features in Chapter 2). The Proposed Action is expected to result in a slight short-term decrease in snags followed by an increase over the long-term. This short term loss of snags is not expected to affect the overall distribution of Allen's lappet-browed bats on the forest. Broadcast burning would also result in the removal of cover and food; however, it is anticipated that meadows and open areas would rebound within a year after treatments, with increased growth and vigor of herbaceous vegetation. The reduction of dense forest canopy and increased growth in the herbaceous vegetation on the forest floor would result in healthy understory habitats and increased insect diversity, providing increased foraging opportunities to bats. Forest conditions after treatment would improve bat habitat within the project area. Additionally, spring restoration and water tank exclosures would improve riparian vegetation, increasing availability of food for bats over the long-term, resulting in indirect beneficial impacts.

Northern Leopard Frog

Affected Environment

The northern leopard frog inhabits Northern and Central Arizona, from an elevation of 2,640 to 9,155 ft. (AGFD 2002b). This species is usually found in montane streams and wetlands that have aquatic vegetation, but also in wet meadows at higher elevations. Occurrence of the leopard frog is restricted to permanent waters. Chyrid fungus and non-native predators such as bullfrogs and crayfish have had detrimental effects on leopard frog populations in the southwest. Other

threats include habitat alteration and trampling by livestock. Wildlife tanks in the project area previously used for livestock grazing provide potential habitat for northern leopard frogs throughout the year. Coconino National Forest records show one observation of a northern leopard frog was made 550 feet outside the project area at Viet Springs in 1989, and another observation of a "Leopard Frog" was made 430 feet outside the southwest portion of the project area in or near Pipeline Tank in 1992. Reduced riparian vegetation around Maxwell Springs from grazing pressure (by both historic grazing and browsing by wild ungulates) and around Big Leroux Springs from water diversion have reduced the suitability of these areas for northern leopard frogs.

Environmental Consequences

Alternative 1: No Action
Direct and Indirect Effects

The No Action Alternative would not have any direct effects on northern leopard frog. However, over time dense forest would continue to have high risk of stand replacing fire. Stand replacing fires could result in increased overland flow, high soil erosion, and increased sediment loads. Water quality would be affected, resulting in indirect adverse effects on northern leopard frog (Hossack and Pilliod, 2011). Additionally, spring restoration activities would not occur; thus the potential habitat enhancement would not occur.

Alternative 2: Proposed Action
Direct and Indirect Effects

Under the Proposed Action, there would be no direct effects to northern leopard frog eggs, larvae or adults from mechanical treatment and/or prescribed burning. Increased flow would potentially occur at springs resulting in increased pooling and increased riparian vegetation growth, resulting in beneficial effects to northern leopard frog habitat.

Bald Eagle

Affected Environment

The bald eagle was removed from the list of threatened and endangered species in 2007 (USDI 2007). Eagles are currently protected under the Golden and Bald Eagle Protection Act and are a Forest Service sensitive species. Bald eagles are typically winter visitors on the Coconino National Forest, concentrating in areas that provide a reliable food source and adequate roosting habitat. Eagles forage widely and opportunistically on carrion, waterfowl, fish, or small mammals. Foraging opportunities are available along Highway 180, where the potential for frequent road-kill may provide a regular food source. AGFD has identified the highway corridor as a bald eagle winter concentration area.

Bald eagle winter roosts do not exist within the project area although winter roost habitat is present. The nearest known winter roost is located approximately nine miles east of the project boundary. Potential roosting habitat within the project area include groups of old-growth ponderosa pine that are dominated by large, open trees occurring on the north- and northeast-facing slopes of Wing Mountain. Roosts on the Coconino National Forest are often associated with water bodies large enough to support reliable populations of fish and waterfowl. Although the project area does not contain any such water bodies, bald eagles may still establish roosts in

the area, given the presence of suitable tree stands and the proximity of road-kill as a reliable food source. Recruitment of future suitable winter roost habitat has been reduced by wildfire suppression, which has facilitated the expansion of dense stands of small trees and thus prevented the development of large diameter trees and snags.

There are no known nesting bald eagles within the project area. The closet known breeding bald eagles use two nests along Lower Lake Mary that are located 14 and 15 miles from the southern boundary of the project area. In Arizona, bald eagles typically nest within one mile of a major river or waterbody, and most breeding areas contain riparian vegetation (Driscoll et al. 2006). These components are not present within one mile of the project area, and it is unlikely that the project area will provide nest sites for bald eagles in the future.

Habitats for small mammals that rely on meadows and open areas are being encroached upon by conifers, so their reliability as a prey source has declined with reductions in habitat quantity and quality for these prey species.

Environmental Consequences

Alternative 1: No Action
Direct and Indirect Effects

The No Action Alternative would not have any direct effects on bald eagle. However, dense forest conditions would persist and the threat of high fire hazard would continue to place bald eagle roosting and foraging habitat at risk for stand replacing fire. High tree densities would continue to limit tree development into large diameter (≥ 18 inches dbh) trees important for roosting. Meadow encroachment would continue reducing habitat for open county species such as rabbits and prairie dogs, thus reducing the prey availability for bald eagle.

Several past, present, and reasonably foreseeable actions and events have contributed, are contributing, and will contribute to the fitness of bald eagles on the Coconino National Forest:

- A loss of large, old trees occurred on slopes less than 40%, due to logging activities during the early stages of Forest Plan implementation (late 1980s and early 1990s).
- Grasslands, meadows, and wetlands – including those in the Southwest – require periodic disturbance from fire (USDA 2010). Historic fire exclusion from wetlands decreased the amount of open-water habitat for waterfowl. The Forest Service excluded fire from the Coconino National Forest throughout much of the twentieth century, causing the encroachment of trees onto meadows and grasslands; this reduced, fragmented, and degraded foraging habitat for eagles.
- Historic overgrazing has reduced protective cover and food for terrestrial vertebrates, which reduces their population size and the amount of prey for eagles. This could potentially reduce the fitness of eagles on the Forest.
- Past use of dichlorodiphenyltrichloroethane (DDT) caused a decrease in the population of raptor species, including bald eagles. A ban on this chemical has caused the species to continually grow in population size (BNA Online 2010).
- Recreation (boating, use of off-highway vehicles, fishing, hiking, etc.) in and around lakes has occurred and continues to occur in and around the project area. Recreationists may disturb eagles and cause them to abandon suitable habitat (BNA Online 2010).
- The removal of hazardous trees for powerlines and highways has reduced and will continue to reduce the number of snags and large trees in the project area.

- The extirpation of gray wolves and grizzly bears from the Coconino National Forest, in combination with the widespread reintroduction of elk, may have caused an unnaturally high level of elk-grazing in meadows and grasslands. This may have reduced the amount of cover and food for small mammals, which likely decreased the fitness of these species, which in turn may have decreased the fitness of their predators (including bald eagles).
- Illegal fuelwood harvest has caused and will continue to cause a loss of snags.
- Insect and disease outbreaks have killed and will continue to kill trees. Insect- and disease-related mortality creates more snags, and eventually, downed logs. Terrestrial prey use downed logs, and eagles use snags for nesting, roosting, and as foraging perches. However, eagles also use large, live trees that insects and disease kill.
- Climate change is expected to increase the risk of high-intensity wildfires (Marlon et al. 2009) and result in higher temperatures and more prolonged droughts, which are likely to result in mortality of larger trees (Van Mantgem et al. 2009).

By maintaining high levels of hazardous fuels and limiting tree growth, the No Action Alternative would hinder the conservation of the habitat of bald eagles and their prey. It would exacerbate the effects of historic timber management, historic overgrazing, historic fire exclusion, past use of DDT, recreation, elk-grazing, illegal fuelwood harvest, and hazard-tree removal. The No Action Alternative may therefore have an adverse impact on bald eagles.

Alternative 2: Proposed Action
Direct and Indirect Effects

Under the Proposed Action there would be no direct effects to nesting or roosting bald eagles. However, project activities may cause visual or auditory disturbance to foraging bald eagles. The disturbance would be of low intensity and short duration.

Indirect effects to bald eagle would be effects to eagle prey species and their habitat. Thinning treatments under the Proposed Action would result in decreased tree density and the creation of small openings, thereby increasing herbaceous vegetation and hence increased forage and cover for bald eagle prey species such as ground squirrels and rabbits. Additionally, the restoration of grassland and meadow would increase habitat for open country species, thus increasing prey availability for bald eagle.

The Proposed Action may adversely impact the species in the short term but would cause a long-term beneficial impact. It would combine with several past, present, and reasonably foreseeable actions and events for a cumulative effect on the fitness of bald eagles. For details on contributing factors under consideration, see the "Cumulative Effects" section of the No Action Alternative above. In the context of these other factors, the Proposed Action may impact bald eagles, but its cumulative contribution is not likely to cause a trend toward listing or loss of viability.

Other Forest Service Sensitive Species

American Peregrine Falcon, Western Burrowing Owl, Ferruginous Hawk, Dwarf Shrew, Merriam's Shrew, Navajo Mogollon Vole, Long-tailed Vole, Townsend's Big-eared Bat, Spotted Bat, Four-spotted skipperling, Mountain Silverspot Butterfly, and Blue-black Silverspot Butterfly.

The types of habitats utilized by these species include grasslands, meadows, shrubland, pinyon-juniper woodland, mixed conifer (including spruce-fir), ponderosa pine, aspen, seeps, springs,

and streams. None of these species have been documented to occupy the project area, but suitable foraging and/or nesting/roosting habitat may be present.

Environmental Consequences

Alternative 1: No Action
Direct and Indirect Effects

The No Action Alternative would not directly affect the Forest Service Sensitive Species listed above; however, there could be a long term negative effect to these species. The forest would remain at a severe fire hazard, dense stands of ponderosa pine would not allow stands of large trees to grow to full potential, and encroachment into woodlands, meadows, and grasslands would continue. If a severe wildfire occurred, it would impact soil and watershed health affecting production of cover, seeds, and forage over the next several decades. Therefore, forest, grassland, and meadow habitats would all degrade.

Cumulative Effects

Several past, present, and reasonably foreseeable actions and events have contributed, are contributing, and will contribute to the fitness of sensitive species on the Coconino National Forest:

- Historic overgrazing decreased the amount of herbaceous cover and food for wildlife, which likely decreased the fitness of some species.
- Grasslands and meadows, including those in the Southwest, require periodic disturbance from fire (USDA 2010). The Forest Service excluded fire from the Coconino National Forest throughout much of the twentieth century, causing the encroachment of trees onto meadows and grasslands; this reduced, fragmented, and degraded habitat. Furthermore, it has increased the potential of high-severity wildfires, which could cause direct mortality of wildlife and a long-term loss of microhabitat (e.g., downed logs and woody debris).
- Recreation (e.g., off-road vehicle driving, hiking, biking, and camping) and road travel reduce vegetation and compact soils. Recreational activities would continue to occur in the project area, resulting in decreased and/or degraded habitat. Recent implementation of the Travel Management Rule will help reduce off-road vehicle driving, restore habitat, reduce impacts to soils and watersheds, and improve habitat for many species.
- Farmers, municipalities, and industry continue to compete for the scarce water (BNA Online 2010). As human population size increases, pressure on water resources will escalate. This may cause a reduction in water levels in lakes, reservoirs, and other wetlands used by northern leopard frogs, thereby reducing and degrading the habitat of the species.
- Insect and disease outbreaks have killed and will continue to kill trees. Insect- and disease-related mortality creates more snags, and eventually, downed logs. Downed logs serve as protective cover for wildlife. Therefore, insect and disease outbreaks may increase protective cover for wildlife.
- Climate change is expected to increase the risk of high-intensity wildfires (Marlon et al. 2009) and result in higher temperatures and more prolonged droughts, which are likely to result in mortality of larger trees (Van Mantgem et al. 2009)

The No Action Alternative would perpetuate high fire hazard rating, the suppression of fire, the encroachment of grasslands and meadows by trees. This high fire risk would result in a higher likelihood of high severity fire, which if it occurs would exacerbate the reduction in habitat for wildlife from historic overgrazing, historic fire exclusion, ongoing elk-grazing, and ongoing recreation impacts. The No Action Alternative may therefore have an adverse effect on these Forest Service Sensitive Species.

Alternative 2: Proposed Action
Direct and Indirect Effects

The Proposed Action would improve habitat conditions for all species by reducing the risk of wildfire in ponderosa pine, aspen, and mixed conifer forests, reducing encroachment into meadows and grasslands, , and by improving understory vegetation diversity and abundance. Road decommissions, road closures, and road realignments would restore more native habitat and reduce disturbance by humans.

Mechanical treatment of hazardous fuels, prescribed fire, temporary road construction, road decommissions, and road re-contouring may reduce the habitat of sensitive species in the short term or cause direct mortality, but such effects would unlikely cause a trend toward listing or loss of viability. The Proposed Action may adversely impact the sensitive species in the short term but would cause long-term beneficial impacts by improving habitat and reducing the risk of severe wildfire.

Cumulative Effects

The Proposed Action would combine with several past, present, and reasonably foreseeable actions and events for a cumulative effect on the fitness of Sensitive Species. For details on contributing factors under consideration, see the "Cumulative Effects" section of the No Action Alternative above. In the context of these other factors, the Proposed Action may impact Sensitive Species, but its incremental contribution is not likely to cause a trend toward listing or loss of viability. Adjacent fuel reduction projects (Fort Valley, Hart Prairie, 4FRI) would combine with this project to create a mosaic pattern of forest conditions and increase open meadow and savannah habitat, thus supporting many of these species. Additionally, the Wing Mountain project and adjacent similar projects would counteract the effects of climate change by making the forest more resilient and resistant to the effects of increased wildfire, drought and pest and disease activity.

Management Indicator Species (MIS)

Affected Environment

The Coconino National Forest Land Management Plan identified 17 wildlife species as Management Indicator Species (MIS) to monitor the conditions of the forest's ecosystems. All 17 MIS were considered for this analysis; however, because of limited habitat (vegetation) types found within the analysis area, only 11 species were found to have the potential of being affected by implementation of the activities associated with proposed project. Table 24 lists MIS species known to occur in the project area.

Table 24: Management Indicator Species occurring in the project area and their indicator habitats and current trends

MIS Species	Indicator Habitat	Applicable MA within Wing Mountain Project area	Forest Habitat Trend	Forest Population Trend
Mexican spotted owl	Late seral mixed-conifer and spruce-fir	3,4	Declining	Inconclusive
Northern goshawk	Late seral ponderosa pine	3,4	Declining	Variable
Wild turkey	Late seral ponderosa pine	3,4	Declining	Increasing
Hairy woodpecker	Snag component of ponderosa pine, mixed-conifer, spruce-fir	3,4	Ponderosa pine snags decreasing, mixed-conifer and spruce-fir snags increasing	Stable-to-slightly increasing
Red-naped sapsucker	Late seral and snag component of aspen	5	Declining	Stable
Elk	Early seral pinyon-juniper, ponderosa pine, mixed-conifer, spruce-fir	3,4	Pinyon-juniper stable, ponderosa pine stable, mixed-conifer and spruce-fir increasing	Stable
Pygmy nuthatch	Late seral ponderosa pine	3,4	Declining	Stable
Mule deer	Early seral aspen and pinyon-juniper	5	Pinyon-juniper stable, aspen declining	Declining
Pronghorn	Early and late seral grasslands	9	Stable-to-declining	Declining
Red squirrel	Late seral mixed-conifer, spruce-fir	3,4	Declining	Inconclusive
Abert's squirrel	Early seral ponderosa pine	3,4	Stable	Inconclusive

Environmental Consequences

Alternative 1: No Action
Direct and Indirect Effects

The No Action Alternative does not result in a change in forest-wide habitat for any of the MIS species listed above. However, it would degrade habitat in the long term as the forest, grasslands, and meadows of the project area are in need of restoration. The No Action Alternative would perpetuate the unnaturally dense conditions in the coniferous forests of the project area and conifer encroachment within aspen stands. In addition, unnaturally dense forests increase the probability of stand-replacing wildfire. Such fire would degrade or destroy the late-seral forest, large trees, and snags on which some MIS species rely.

Cumulative Effects

The No Action Alternative would exacerbate the reduction in habitat from the cumulative impacts of historic timber management, historic fire exclusion, and recreation. Additionally, climate change is likely to result in more severe wildfires, drought and increased tree mortality across the landscape, thereby decreasing habitat components important to MIS. The No Action alternative would not lessen the impacts of climate change, and may therefore have an adverse effect on the MIS species listed in Table 24 above.

Alternative 2: Proposed Action
Direct and Indirect Effects

Thinning and prescribed fire would improve habitat for many of the MIS. By thinning unnaturally dense forest, the proposed action would reduce competition among trees and promote the growth of larger trees. Using uneven-aged management would help create forest structure including increasing both early and late seral ponderosa pine, lending to habitat conditions that many MIS favor and in which, thrive. The probability of stand replacing wildfire would also be reduced under the Proposed Action, thereby conserving large trees and snags over the next several decades that several MIS rely on.

Managing aspen stands by reducing conifer encroachment through thinning, deterring heavy ungulate browsing through jackstrawing and fencing, and promoting aspen regeneration through prescribed burning, thinning, fencing, and jackstrawing would enhance habitat characteristics on which some of the MIS depend. Furthermore, silvicultural treatments would set the stage for the creation of large snags over time as large, mature trees die successively. Overall, the Proposed Action includes mechanical treatment, prescribed fire, temporary road construction, road decommissions that may temporarily disturb MIS species, reduce habitat in the short term, or cause direct mortality, but such effects are too small to alter Forest-wide habitat or populations trends for the species. Conversely, habitat quality for MIS would increase as a result of the proposed treatments (including spring restoration), but the increase would be insufficient to affect forest wide habitat or population trend for MIS.

Cumulative Effects

Many past, present, and reasonably foreseeable actions have affected and continue to affect MIS habitat, including: historic timber management, historic fire exclusion, recreation, insect and disease infestation, hunting, and cattle grazing. Most of these activities have reduced habitat within the Project Area and across the forest. However, when considered in the context of the

cumulative impact of these actions, the Proposed Action does not result in a substantial increase or decrease in habitat forest-wide for any of the MIS species and does not meaningfully change the forest-wide trend for habitat. Adjacent fuel reduction projects (Fort Valley, Hart Prairie, 4FRI) would combine with this project to create a mosaic pattern of forest conditions and increase open meadow and savannah habitat, thus supporting many of these species. Additionally, the Wing Mountain project and adjacent similar projects would counteract the effects of climate change by making the forest more resilient and resistant to the effects of increased wildfire, drought and pest and disease activity.

Migratory Birds

Affected Environment

President Clinton signed Executive Order 13186 on January10, 2001, placing emphasis on conservation of migratory birds. Numerous migratory bird species occur within the project area. Several species are evaluated in the Endangered Species Act section (Mexican spotted owl), Forest Service Sensitive Species section (northern goshawk, bald eagle, peregrine falcon, ferruginous hawk) and Management Indicator Species section (red-naped sapsucker). Effects were also evaluated for bird species of conservation concern that potentially occur within the project area. These species are known as Arizona Partners in Flight Priority Species (Latta et al. 1999) and U.S. Fish and Wildlife Service Birds of Conservation Concern (U.S. Fish and Wildlife Service 2008) and they include olive-sided flycatcher (*Contopus cooperi*), Cordilleran flycatcher (*Empidonax occidentalis*), purple martin (*Progne subis*), Swainson's hawk (*Buteo swainsoni*), grasshopper sparrow (*Ammodramus savannarum*), flammulated owl (*Otus flammeolus*), Lewis' woodpecker (*Melanerpes lewis*), olive warbler (*peucedramus taeniatus*), and Grace's warbler (*Dendroica graciae*). There are no designated Important Bird Areas within or adjacent to the project area.

Environmental Consequences

Alternative 1: No Action
Direct and Indirect Effects

There would be no risk of incidental mortality of birds as a result of project implementation activities because no treatments would occur under the No Action Alternative. However, risk of large-scale, high-severity crown fire would continue to increase. If a stand replacing fire occurred within the project area, the result would be long-term habitat loss/degradation for nearly all of the bird species listed above.

Cumulative Effects

The No Action Alternative would exacerbate the reduction in habitat from the cumulative impacts of historic timber management, historic fire exclusion, recreation and climate change. Climate change is likely to result in more severe wildfires, drought and increased tree mortality across the landscape, thereby decreasing migratory bird habitat. The No Action alternative would not lessen the impacts of climate change, and may therefore have an adverse effect on migratory birds.

Alternative 2: Proposed Action
Direct and Indirect Effects

The Proposed Action project implementation activities could potentially result in some incidental mortality of birds due to the use of heavy equipment causing disturbance to nest sites, felling of trees during thinning, and disturbance to birds during prescribed burning. These activities could cause the loss of eggs or nestlings. However, this risk is considered to be minimal (Pilloid et al. 2006).

The level of incidental mortality caused by project implementation activities would be proportional to how many acres would be treated during the spring nesting season of April, May, June, and July. Seasonal restrictions under the Proposed Action would limit project implementation activities between March 1 and September 30 in northern goshawk nest areas and PFA stands, and from March 1 to August 31 for occupied MSO PACs, which would reduce the potential mortality of species in ponderosa pine habitat. Most of the prescribed burning on the project would occur during the fall, outside of the spring nesting season, so effects to breeding birds would be negligible.

Cumulative Effects

Many past, present, and reasonably foreseeable actions have affected and continue to affect migratory bird habitat, including: historic timber management, historic fire exclusion, recreation, insect and disease infestation, hunting, and cattle grazing. Most of these activities have reduced habitat within the project area and across the forest. However, when considered in the context of the cumulative impact of these actions, the Proposed Action does not result in a substantial increase or decrease in habitat forest-wide for migratory birds. Adjacent fuel reduction projects (Fort Valley, Hart Prairie, 4FRI) would combine with this project to create a mosaic pattern of forest conditions, thus supporting many of these species. Additionally, the Wing Mountain project and adjacent similar projects would counteract the effects of climate change by making the forest more resilient and resistant to the effects of increased wildfire, drought and pest and disease activity.

Travel Corridors

The San Francisco Peaks – Mogollon Rim Wildlife Travel Corridor has been identified and established by the Arizona Game and Fish Department and lies within the project area. The travel corridor is a wildlife travel way that connects the San Francisco Peaks with the Mogollon Rim, Sycamore Canyon, and Oak Creek. The travel corridor was identified by modeling focal species that occur in both the San Francisco Peaks and Mogollon Rim areas.

Treatments under the Proposed Action are compatible with Arizona Game and Fish Department recommendations for treatments within the corridor. For example, the Proposed Action emphasizes forest heterogeneity through uneven-aged management and includes grassland and meadow restoration and hand thinning or burn only treatments on steep slopes (>40%). Thus, the proposed action would likely enhance the function of the travel corridor by improving habitat features for migration of focal species over the long-term. The No Action alternative would have no direct effects to the travel corridor, but would leave the area vulnerable to high-intensity wildfire over the next several decades. Should a high-intensity wildfire occur in the travel corridor, it would likely remove important hiding and thermal cover and contiguous forest habitat needed for migration of focal species within this corridor.

Soils

Affected Environment

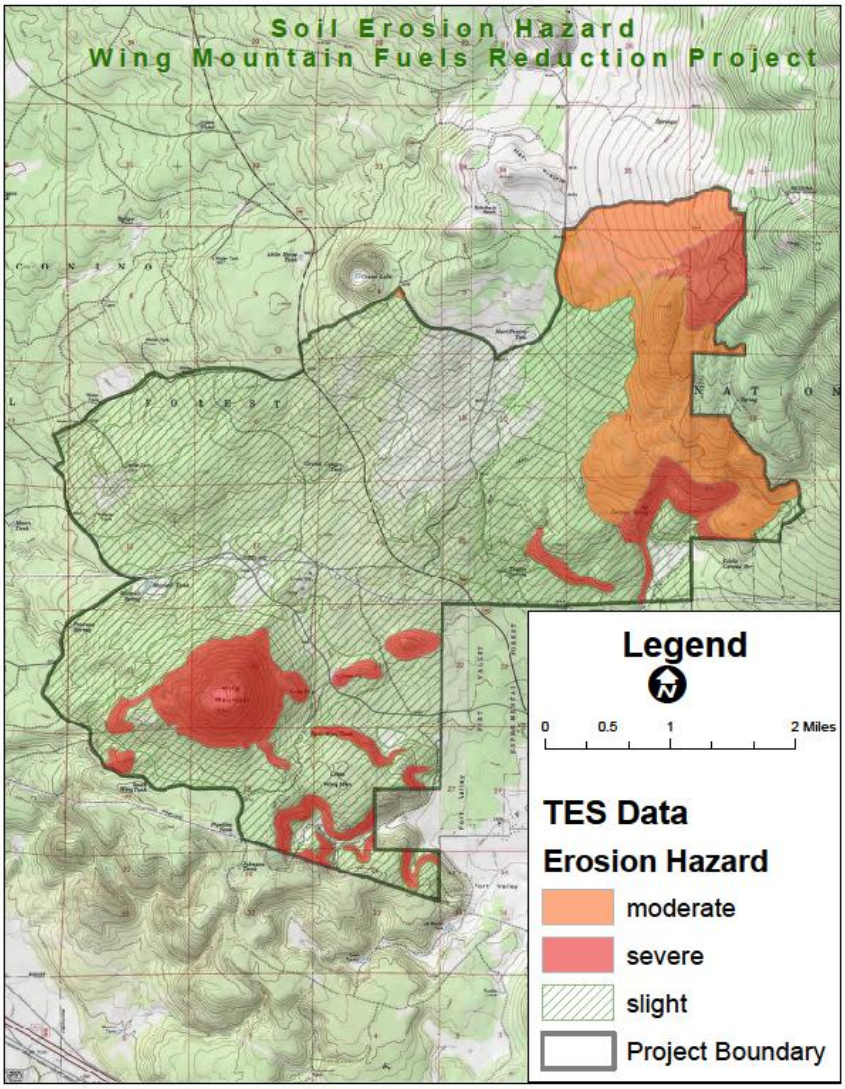
Soils in the project area were mapped as part of the Terrestrial Ecosystem Survey of the Coconino National Forest (Miller, et.al., 1995). The Terrestrial Ecosystem Survey (TES) is used to evaluate and adjust land uses to the limitations and potentials of natural resources and the environment. It presents important properties pertaining to the natural, physical, and behavioral characteristics of the terrestrial ecosystems and provides the background for making interpretations.

Erosion hazard for TES map units are displayed in Figure 8. The TES defines erosion hazard based on bare ground (complete removal of vegetation and litter). A slight rating indicates that all vegetative ground cover could be removed from the site and the resulting soil loss would not exceed "tolerance" soil loss rates. Tolerance soil loss is the maximum rate of soil loss that can occur without compromising inherent site productivity.

A moderate rating indicates that predicted rates of soil loss would result in a reduction of site productivity *if left unchecked*. Conditions in moderate erosion hazard sites are such that reasonable and economically feasible mitigation measures could be applied to reduce or eliminate soil loss.

A severe rating indicates that predicted rates of soil loss have a high probability of reducing site productivity before mitigating measures could be applied. Within the analysis area, there are about 8,285 acres of slight erosion hazard soils, approximately 1,500 acres of moderate erosion hazard soils, and nearly 1,380 acres of soils with severe erosion hazard (Figure 8). Areas with severe erosion hazards are often found on steep slopes (exceeding 40%) such as TES map unit 562, a cinder cone with soils exhibiting severe erosion hazard. Forest Plan guidance limits mechanized harvesting activities on slopes above 25% on cinder cones. Map units 562 and 613 are also on very steep slopes (exceeding 40% slope) creating a severe erosion hazard.

Figure 8: Erosion Hazard within Wing Mountain analysis area (Miller et al. 1995).



Soils are placed into one of three classes based on soil condition ratings: satisfactory, impaired, and unsatisfactory. These soil condition ratings are based on interpretations of the three primary soil functions: soil hydrologic function, soil stability and nutrient cycling. In general, hydrologic function of the soil is assessed based on indications of reduced infiltration through compaction and modification of surface soil structure, as measured by a single ring infiltrometer or other similar measuring device. Soil stability is generally assessed through visual inspection of the soil surface for evidence of erosion including rilling, pedestaling (i.e., plants or rock fragments elevated above surrounding soil), and soil displacement. Nutrient cycling is generally assessed by visual observation of surface litter (distribution and depth), presence of coarse woody material, and root distribution within the surface soil horizons. Soils associated with all TES map units in the project area were rated to be in satisfactory condition.

Soil typing performed in the project area supports the conclusion that historically the area contained grasslands, meadows, and open canopy conditions (see Soil/Watershed Specialist Report in the project record for more details on soil typing).

Environmental Consequences

Alternative 1: No Action
Direct and Indirect Effects

Plant community structure, including species diversity, growth habit, and distribution, has been suggested as an indicator of nutrient cycling and energy flow (NRC, 1994). A change in structure that results in a less even utilization of solar energy (for example, a shift from a mix of perennial and annual species to predominantly, annual species) and less even utilization of moisture and nutrients within the soil profile may be indicative of a decrease in nutrient cycling (NRC, 1994). This suggests that the shift from a more open pre-European settlement forest structure with herbaceous cover and shrubs occupying the intercanopy spaces to a closed canopy monoculture forest has reduced nutrient cycling, an important soil function.

The likelihood of a stand-replacing fire under the current (no action) forest structure poses a serious risk to soil condition (see the Fire and Fuels section of this chapter). These types of fires can result in large losses of soil nutrients through volatilization, mineralization, and subsequent accelerated erosion (Neary, et.al., 1999). In addition, adverse impacts to soil hydrologic functioning (i.e., reduced infiltration through consumption of soil organic matter, loss of soil structure, and formation of soil hydrophobicity), soil stability, and nutrient cycling can occur (Neary, et.al., 1999).

Under the No Action Alternative, the current inventory of approximately 79.62 miles of Forest Service roads, including those within the analysis area and some roads that have segments outside of the analysis area but would be used as timber haul routes under Alternative 2, would remain unchanged though some road closure would occur as required under the Travel Management Rule. Though closed, these roads would not be restored to productive condition through such activities as road bed ripping and reseeding. The soils associated with these unpaved roads typically have low infiltration rates as a consequence of compaction and are more susceptible to wind and water erosion owing to a lack of vegetative cover. The exposure of bare mineral soil on road beds leads directly to soil displacement from raindrop impact and vehicle use and can indirectly lead to soil displacement through increased surface runoff.

Cumulative Effects

Cumulative effects to soils were only analyzed within the analysis area since the effects to soils are generally confined to the area of disturbance. Past, ongoing and reasonably-foreseeable projects for roughly the next 20 years were considered in this analysis.

Though past and ongoing activities such as recreation and wildfire contribute effects to soil resources in the project area, the No Action alternative would not add any additional ground disturbing activities within the cumulative effects analysis area; therefore, there would be no direct cumulative effect from this alternative.

Alternative 2: Proposed Action
Direct and Indirect Effects

The proposed action would reduce the risk to soil resources from the deleterious effects of a stand-replacing fire. The opening of the canopy would likely result in an increase in the understory diversity of plant species. This would be expected to improve nutrient cycling as more of the soil profile would be exploited and a higher diversity of litter cover would be maintained. The proposed action would also result in the obliteration of approximately 5 miles of roads and decommissioning of 49 miles of roads. Obliteration of roads would restore soil productivity and soil functionality through such methods as ripping and re-seeding, recontouring, and/or other methods of road removal.

Treatments of various kinds would be expected to have short-term negative impacts to soil resources. Prescribed burning would occur on approximately 10,930 acres under this alternative with about 1,740 acres of burn only treatments and the remainder to be conducted after thinning. Humidity, air temperature, fuel loadings and fuel moistures would be within ranges that are conducive to prescribed burning that lead to positive ecological effects. These conditions typically produce low severity fire in which surface litter is only partially consumed. Localized areas of higher severity fire could occur leading to decreased soil function (i.e., nutrient cycling and infiltration). Prescribed burning can effect soil resources through reduction of course woody debris, damage to soil physical structure, and damage to soil biological features (Cooper, 1961; Graham et al, 1994; Neary et al, 2005), as well as providing positive effects through nutrient flushes from the burn (Covington and Debano, 1990). This increase is short-lived due to rapid biological and chemical immobilization of released nutrients. The effects from fire are directly related to fire intensity, with the general rule of thumb that the greater the burn intensity, the greater the amount of damage to forest soils (Neary et al, 2005).

It is expected that a majority of the prescribed burn area on the first burn entry would be in the duff/litter portion, and would actually have a positive affect due to soil nutrient increases. A smaller percentage of the burned area would be in the moderate sized material, and would have a localized impact to soil biotic material by reducing soil respiration through higher soil temperatures; however, soil temperatures would not be expected to be high enough to do damage to soil physical structure. The larger sized material (10"+ size material) would have the greatest affect to soil properties, similar to the pile burning affects. With the implementation of Best Management Practices (Design Features, Chapter 2), the effects to soil resources from burning would be minimized for the proposed action. No long-term loss of soil productivity would occur from the presecribed burning activities. Conversely, prescribed burning would be expexcted to have a long-term benefit to soil resources by reducing the build-up of fuels, and restoring soil nutrient cyling through reduction of overtstory and encouragement of herbaceous cover.

Thinning of trees less than 5 inches dbh is generally done by hand using chainsaws (hand thinning) but could be accomplished through other mechanized means such as mastication. This type of thinning would be accomplished on approximately 210 acres and would also potentially occur on all or a a portion of meadow restoration thinning treatments on 520 acres. Limited ground disturbance would occur under hand thinning from vehicles driving off road. This ground disturbance could lead to soil compaction and soil displacement from wheeled vehicles but would be limited by only conducting treatments when soil conditions are such that excessive damage would not occur.

Mechanical thinning typically involves the use of various ground-based equipment for felling, extracting, processing, loading, and trucking the harvested timber. These harvesting processes

disturb the soil through temporary road construction, surface skidding of felled trees to landings, collection and disposal of slash, and hauling of harvested trees on Forest Service roads. Impacts to soils can include, but are not necessarily limited to, displacement of litter exposing soils to raindrop impact, displacement of topsoil exposing subsurface soil horizons, rutting of soils potentially concentrating runoff, and compaction of soils leading to decreased infiltration. All these impacts have the potential to alter the watershed's rainfall/runoff response and increase erosion. The amount of soil disturbance that leads to erosional consequences, however, is difficult to predict and depend on a number of site- and operator-specific variables including climate, terrain, geology, vegetation, soils, timing of harvesting activities, and operator performance (Coats and Miller, 1981). Best management practice monitoring on the Mogollon Rim Ranger District (Jagow, 1994; Fleishman, 1996 and Fleishman, 2005) has shown that ground disturbance may occur on approximately 10-15% of mechanical thinning areas. Impacts to soil resources would be minimized through various BMPs identified in Chapter 2. Ground disturbance also occurs from the creation of slash piles at landings and the processing (burning) of those piles. This can create a areas of 0.2 to 3 acres in size where non-desirable exotic plants can be established on the burn scares of slash piles (Korb et al, 2004). This is expeted to occur on less than 1% of the project area, or on sites that are already disturbed.

Aspen restoration treatments may include a variety of treatments to try and regenerate aspen, including ripping, thinning, and burning of aspen, then creating jackstraws of downed trees. It is estimated that 30-50% of the aspen sites would have ground disturbance down to mineral soil, or about 80 to 130 acres are expected to be disturbed in these treatments. The remaining areas where tree removal is proposed are expected to have minimal ground disturbance (meadow restoration with limited mechanized impact on about 1-5% of the area or 5 to 25 acres).

Cumulative Effects

Cumulative effects to soils were only analyzed within the analysis area since the effects to soils are generally confined to the area of disturbance. For the proposed action alternative, cumulative effects to soils would occur from the treatment activities associated with the proposed action and from other soil disturbing activities that have already been discussed as contributing factors under the Cumulative Effects section of the No Action Alternative.

Most of the cumulative impacts to soils for the proposed action are temporary in nature including disturbances from treatment activities and wildfires. Cumulative effects to soil resources from recreational activities that utilize existing trails and roads would be reduced owing to the closure and obliteration of forest roads under the proposed action and from ongoing implementation of the Travel Management Rule which began May 1, 2012.

Watershed

In order to assess and prioritize watersheds in a consistent fashion, the Forest Service developed the Watershed Condition Framework (WCF) (USDA Forest Service, 2011). The WCF establishes a reconnaissance-level approach for classifying watershed condition, using a comprehensive set of 12 indicators that are surrogate variables representing the underlying ecological, hydrological, and geomorphic functions and processes that affect watershed condition. The indicators are divided into aquatic physical, aquatic biological, terrestrial physical, and terrestrial biological categories with a suite of indicators and their attributes for each category (see Soil/Watershed Specialist Report).

The WCF assessment process involves classification of all 6th -level Hydrologic Unit Code (HUC) watersheds on National Forest lands into one of three watershed condition classes based on assigning a numerical score to each of the indicator categories : Class 1—Functioning Properly; Class 2—Functioning at Risk; Class 3—Functionally Impaired (Impaired Function). In general, a 6th code HUC refers to a hydrologic unit mapped at a scale of 1:24,000 and identified by twelve digit codes. For detailed description of HUCs, refer to Soils and Water Specialist Report in the project record located at the Flagstaff Ranger District office.

Affected Environment

The Wing Mountain Fuels Reduction and Forest Health Restoration Project occurs within three 6th-level HUC watersheds, but only two of the 6th code watersheds contain any significant analysis area acreage (Table 25). The Telephone Tank 6th code watershed contains only 128 acres of the analysis area within it.

Table 25: Watersheds within the Wing Mountain analysis area

HUC 6th code name	Total acres	acres in project	% in boundary
Telephone Tank	14,934	128	<1%
Upper Rio de Flag	44,551	6,836	15%
Volunteer Wash	31,771	4,200	13%

The most recent assessment of all 6th-level HUC watersheds in the Coconino National Forest was completed in 2010. The Upper Rio De Flag and Volunteer Wash watersheds were both rated as "functioning at risk." The Forest Health indicator for these watersheds was rated as "fair" whereas the Roads and Trails indicator was rated "fair" and "poor" for Upper Rio De Flag and Volunteer Wash watersheds, respectively. A fair rating for the Forest Health indicator means that a "moderate amount of the forested land in the watershed is anticipated to or is experiencing tree mortality from insects and disease and from air pollution."

A fair rating for Roads and Trails means the "density and distribution of roads and linear features within the watershed indicates that there is a moderate probability that the hydrologic regime is substantially altered" whereas a poor rating means the "density and distribution of roads and linear features within the watershed indicates that there is a higher probability that the hydrologic regime (timing, magnitude, duration, and spatial distribution of runoff flows) is substantially altered." "Existing road density" is an attribute of the Roads and Trails indicator. An attribute rating of "poor" is given when the road density exceeds 2.4 mi/mi^2. The road densities for the Upper Rio De Flag and Volunteers watersheds are 5 mi/mi^2 and 4.63 mi/mi^2, respectively. These ratings apply to the entire watersheds and may not reflect the conditions of the portions of the watersheds within the analysis area.

Streamcourses

Stream flow within the analysis area is typically ephemeral with flow only present in the hours following a storm event though longer duration flow may occasionally occur in response to

elevated soil moisture from snow melt. No perennial streams occur within the analysis area. Approximately 7.9 miles of ephemeral streams occur within the analysis area, none of which have been identified as containing riparian vegeation.

Wetlands and Springs

No wetlands occur within the analysis area. Five springs occur within the analysis area including Taylor Spring, Bert Spring, Big Leroux Spring, Pearson Spring, and Maxwell Spring. These springs have all been modified in some form to serve as water sources for livestock, wildlife, and/or humans. Historic through current human use of Big Leroux Spring is well-documented. Big Leroux Spring is the only source of water for the Flagstaff Hotshot Headquarters (just north of the intersection of Highway 180 and Snowbowl Road). Seasonal daily peak demand has been estimated to be 1700 gallons (Monroe, et.al., 2011). This demand represents roughly 7% of the estimated average daily discharge from Big Leroux spring as determined from manual discharge measurements conducted on a roughly semi-monthly basis since June 2004 by Friends of the Rio De Flag. Big Leroux Spring also indirectly serves as a back-up water source for the Fort Valley Experimental Forest Station by virtue of a pipeline that connects the piping system for Little Leroux Spring (the historic primary water source for the experimental station) with that for Big Leroux Spring. This connection allows that portion of spring water not used at the hotshot headquarters to discharge to a 200,000 gallon cistern at Little Leroux Spring. The overflow from this cistern is, in turn, conveyed through a buried pipeline to an earthen stock tank located at the hotshot headquarters that is no longer used by livestock but may serve as a water source for wildlife. The experimental station has relied on this stored water several times over the past decade when their primary water source (well water) has failed owing to drought conditions.

The existing infrastructure/configuration results in a roughly 56:44 split with 56% of water diverted to the hotshot headquarters and 44% to the hillslope upon which undiverted spring discharge would naturally flow. Other infrastructure associated with the spring is a drainage channel which historically conveyed spring flow to the meadow located south of the spring was modified through excavation to more effectively convey spring water to an earthen tank that was constructed at the north end of the meadow at an unknown date. The earthen tank prevents spring water from entering the meadow where it may have formerly flowed prior to construction of the current or previous diversion system(s).

Big Leroux Spring discharge data collected since June 2004 by Friends of the Rio De Flag indicates that discharge varies seasonally and year to year in response to precipitation with the lowest flow of 6.6 gallons per minute (gpm) recorded on 12 December 2005 and the highest flow of 37.0 gpm recorded on 1 May 2005. During the hotshot headquarters peak season-of-use (April through September), spring discharge varied from 9.8 gpm to 26.0 gpm with an average of 16.1 gpm.

Maxwell Spring was improved for livestock and wildlife use in 1930 with construction of an 8' deep rock-lined spring collection well at the spring's point of emergence. A buried pipe connects the spring well to a downstream stock tank.

Water Rights

There are 9 known Certificates of Water Rights and nine applications for water rights within the project area (see project record). Rights applied include domestic, livestock and wildlife use.

Environmental Consequences

Alternative 1: No Action
Direct and Indirect Effects

Under the No Action Alternative, treatments to improve forest health and reduce the likelihood of a stand-replacing fire would not occur. The existing road network would remain in place although some roads would be closed to public motorized use under TMR, resulting in an open road density of approximately 1.8 miles per square mile. However as administrative use and occasional public use on these closed roads could still occur due to the road beds still being intact, the benefits are less than if those closed roads were decommissioned (as under the Proposed Action). Watershed conditions within the Upper Rio de Flag and Volunteer wash watersheds would likely remain "functioning at risk," a rating that is at least partially attributable to forest health and road density conditions in these watersheds. The increased risk of a stand-replacing fire in these watersheds would make them vulnerable to the deleterious effects from such a fire including increased peak flow and reduced time to peak, reduced infiltration, and accelerated erosion.

Cumulative Effects

Cumulative effects to water resources were analyzed at the 6th-level HUC watershed scale. The affected watersheds include the Upper Rio De Flag and Volunteer Wash watersheds. These watersheds encompass an area of approximately 76,000 acres. Activities occurring within these watersheds over the past decade and the estimated activity area are presented in Table 27. These activities include small to large wildfires and fuels treatments including prescribed burning with A1 East and West, Fort Valley, Woody Ridge, and Hart Prairie project areas.

Table 26: List of past and present actions occurring within the Analysis Area-2001 to present in Cumulative Effects Analysis Area by 6th code watershed

Activity Name	Type	year	total acres
Volunteer Wash			
Activity Name	**Type**	**year**	**total acres**
MISC small wildfires	wildfire	2001	7
MISC small wildfires	wildfire	2002	4
MISC small wildfires	wildfire	2003	6
MISC small wildfires	wildfire	2004	5
MISC small wildfires	wildfire	2005	6
MISC small wildfires	wildfire	2006	9
MISC small wildfires	wildfire	2007	4
MISC small wildfires	wildfire	2008	6
MISC small wildfires	wildfire	2009	9
Hart	wildfire	2002	55

Activity Name	Type	year	total acres
Bismark Lake	wildfire	2006	17
A-1 Burn	Prescribed Fire	2001	3
Bebbs Burn	Prescribed Fire	2003	376
Dauber Burn	Prescribed Fire	2001	304
Hart Prairie	Aspen Restoration	2011	1,968
Hart Prairie	Bebb Willow Restoration	2011	22
Hart Prairie	Burn Only	2011	35
Hart Prairie	Meadow Restoration	2011	1,070
Hart Prairie	Mixed Conifer Restoration	2011	77
Hart Prairie	Ponderosa Pine Restoration	2011	2,578
Hart Prairie	Thin from Below	2011	27
			6,589

Rio de Flag

Activity Name	Type	year	total acres
A-1 East	Timber harvest	2001-2005	1,196
A-1 East	Prescribed Burn	2004-2009	1,196
A-1 West	Timber harvest	2001-2005	543
A-1 West	Prescribed Burn	2004-2009	543
FT Valley Phase 1	Timber harvest	2001-2002	1,725
FT Valley Phase 1	Prescribed Burn	2002-2007	1,764
FT Valley Phase 2	Timber harvest	2004-2008	2,395
FT Valley Phase 2	Prescribed Burn	2005-2010	2,720
Woody	Timber harvest	2004-2008	296
Woody	Prescribed Burn	2005-2010	310
MISC small wildfires	wildfire	2001	24
MISC small wildfires	wildfire	2002	6
MISC small wildfires	wildfire	2003	18
MISC small wildfires	wildfire	2004	19
MISC small wildfires	wildfire	2005	12

Activity Name	Type	year	total acres
MISC small wildfires	wildfire	2006	18
MISC small wildfires	wildfire	2007	22
MISC small wildfires	wildfire	2008	7
MISC small wildfires	wildfire	2009	20
LEROUX	wildfire	2001	1,113
HART	wildfire	2002	30
WOODY	wildfire	2006	107
SCHULTZ	wildfire	2007	5
WING	wildfire	2007	25
OBSERVATORY	wildfire	2008	13
Hart Prairie	Aspen Restoration	2011	113
Hart Prairie	Burn Only	2011	217
Hart Prairie	Meadow Restoration	2011	296
Hart Prairie	Ponderosa Pine Restoration	2011	180
			14,932

Five active range allotments (A-1 Mountain, Crater, Maxwell Springs, Wild Bill, and Windmill West) occur within the cumulative effects analysis area and consist of 43,496 acres. Ground disturbance from livestock is very dispersed and usually small in size, primarily at salting sites and adjacent to stock tanks. For this analysis, it is assumed that dispersed nature of the grazing effects would not add to the cumulative ground disturbance effects.

Table 27 lists the ongoing and foreseeable future actions that may take place within the cumulative effects analysis area. The reasonably foreseeable actions in Table 27 do not have an acreage figure because they are still in the planning stages. As these projects are implemented, the potential amount of ground disturbance within the cumulative effects analysis area may increase in some instances (e.g., Four Forest Restoration Initiative) or decrease in others (e.g., implementation of Travel Management Rule). The geographic setting and the timeframe for cumulative effects analysis for this Alternative is the same as described in the No Action Alternative for soils. The No Action Alternative would not add any additional ground disturbing activities within the cumulative effects analysis area; therefore, there would be no cumulative effect from this alternative

Table 27: Current and foreseeable projects from the Coconino National Forest Schedule of Proposed Actions (Coconino National Forest, 2011)

Project Name	Activity
Four Forest Restoration Initiative EIS: South Kaibab and Coconino	forest restoration[6]

[6] Restoration includes removal of fuels through thinning and burning, restoring natural fire regimes, road decommissioning/closure, and channel/riparian restoration. Projects listed as restoration can have all of these components, or a subset of these components.

Project Name	Activity
Rock Pit Development: Coconino and Kaibab National Forests	road management
Coconino National Forest Motorized Travel Management Plan	road management
Forest-wide Visitor Information Kiosks Project	public information

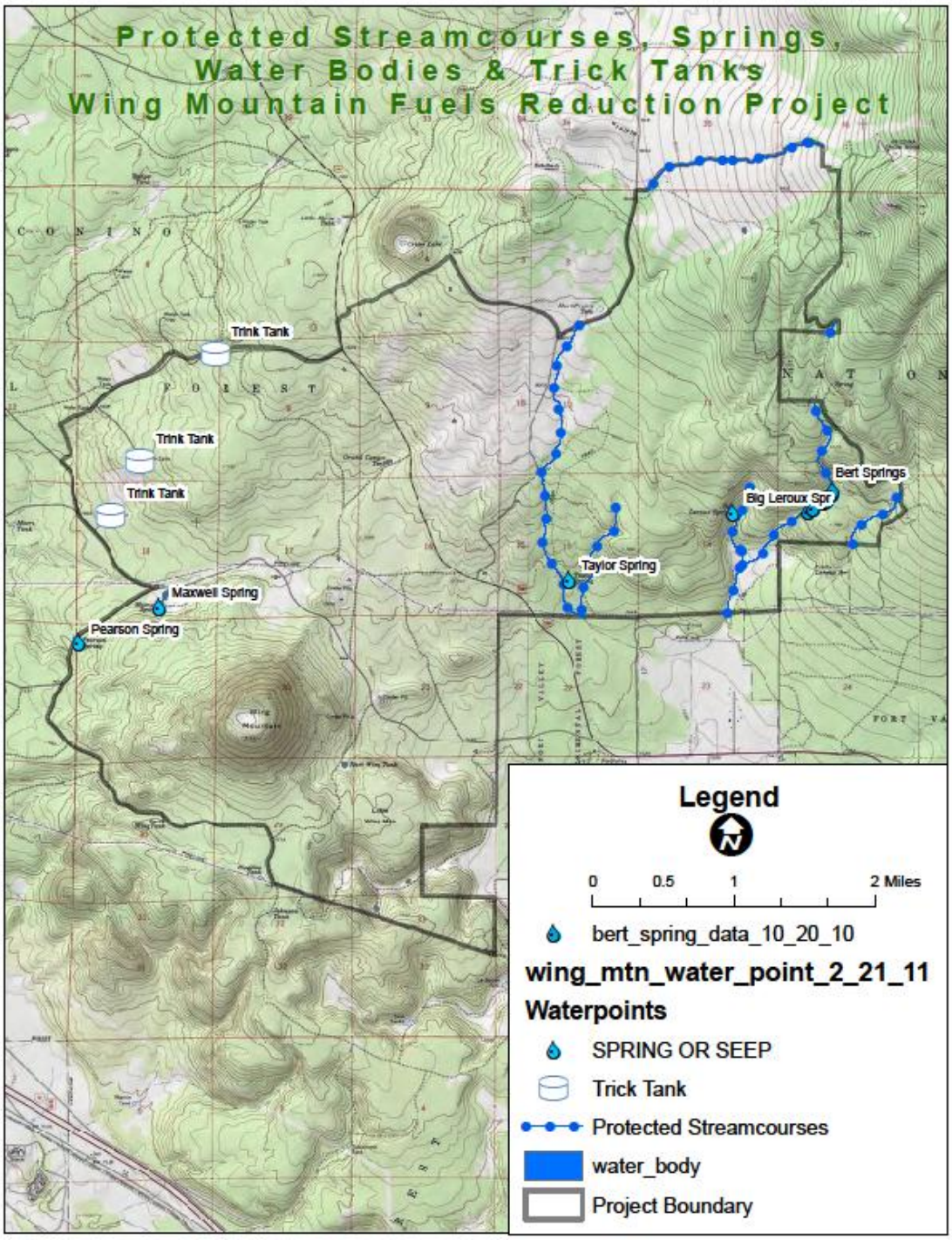
Alternative 2: Proposed Action
Direct and Indirect Effects

The treatments included in the proposed action could cause some negative short-term impacts to water resources but would have an overall positive impact on these resources by decreasing the likelihood of a stand-replacing fire.

Of all practices associated with forest management, roads have been found to have the greatest effect on erosion (Megahan and King, 2004). Forest roads are necessary in order to conduct prescribed burning and thinning operations and new temporary roads would need to be constructed and existing roads accessed to conduct treatment operations. By taking advantage of the existing road network, temporary road construction to facilitate fuels reduction and the removal of forest products would only total approximately 3.25 miles. Temporary roads would be obliterated when thinning operations were completed. Impacts from roads would be minimized through implementation of pertinent BMPs (see Chapter 2). Erosion associated with roads occurs because of the low infiltration rates of road beds and exposure of bare mineral soil to raindrop impact and wind erosion. Low infiltration combined with lack of vegetative cover produces increased surface runoff that has the potential to transport sediment to stream channels although the potential to impact water quality is largely a function of the extent to which runoff from road beds is directly connected to stream channels. In the analysis area, all stream channels are ephemeral though some sustained surface flow may occur in runout channels below springs. In order to minimize impacts to springs, the channels in which they occur or discharge would be designated as protected stream courses (Figure 9).

The proposed action would result in the obliteration of approximately 5 miles of roads and decommissioning of 49 miles of roads decreasing the road density in the affected watersheds and the overall road density in the analysis area to approximately 1.8 miles per square mile. Obliteration of roads would occur through such methods as ripping and re-seeding, recontouring, and/or other methods of road removal. Decommissioned roads would not be open for administrative use, and incidental public use would not be likely due to the removal of an obvious roadbed.

Figure 9: Protected streamcourse, springs, and wetlands within the Wing Mountain analysis area



The removal of forest cover through thinning operations would decrease the interception of precipitation and decrease evapotranspiration potentially increasing water yield from treated areas (Bosch and Hewlett 1982, Stednick 1996). Evapotranspiration is the process by which surface or

ground water is "lost," or removed through either transpiration via vegetation and/or evaporation. In the absence of maintenance treatments, this effect would likely persist for no more than 5 to 10 years as evapotranspiration rates recover with vegetation regrowth (Troendle, et.al, 2010).

Prescribed fire treatment would potentially lead to short-term localized increases in runoff and accelerated erosion as vegetative cover is consumed. Prescribed burning would be conducted under fuel and weather conditions that are conducive to burning to produce desired ecological effects. These conditions typically produce low severity fire in which surface litter is only partially consumed. It is not anticipated that prescribed fire would alter the rainfall/runoff response at the watershed scale.

The restoration of several springs under the proposed action would have an overall positive impact on water resources in the analysis area by restoring historically perennial stream reaches below spring emergence areas. Restoration of Maxwell and Big Leroux Springs would be an initially passive approach relying on volunteers and Forest Service staff as available. Passive restoration efforts focus on reducing or eliminating the sources of degradation and allowing recovery time.

As described in Chapter 2, at Big Leroux Spring, this passive approach would potentially include removal of the existing aboveground concrete tank downhill of the spring, removal of the existing barbed wire fence surrounding the spring, installation of piezometers to monitor soil moisture conditions, and adjustment of the existing diversion valves to allow a portion of the spring flow to discharge to its historic location. By continuously maintaining both valves in the open position, daylighted spring flow would vary in response to natural discharge rather than varying in response to fluctuating human demand for this water.

Under this scenario, diverted spring flow would be sufficient to meet the estimated peak daily water demand of 1700 gallons at the Flagstaff Hotshot Headquarters assuming a daily (24-hour) diversion of 7,920 gallons (56% of the average April through September seasonal flow of 9.8 gpm). This diversionary flow should also be sufficient to provide a backup water source for the Fort Valley Experimental Forest Station since the 200,000 gallon cistern would remain topped off when not in use. Overflow from the cistern would continue to discharge to the earthen stock tank located at the hotshot headquarters providing water for wildlife. The ratio of diverted to naturally discharged spring water would be reduced over time (i.e., more spring water allowed to daylight) if improved estimates of human demand for spring water justify less diversion. Manual discharge monitoring would continue by volunteers or Forest Service personnel with the possibility of installing automated flow monitoring equipment if feasible. Refer to the Soils and Water Specialist Report for more detailed information regarding Big Leroux Spring restoration considerations.

At Maxwell Spring, passive restoration would potentially include modifications to the existing spring well to allow additional spring water to emerge at the surface in order to restore riparian and aquatic habitat.

These actions would potentially lead to short-term effects (less than one year) to existing vegetation and soil associated with channel modifications and fence construction. Disturbance of soil and vegetation would be limited to that necessary to erect exclosure fencing and/or construct habitat improvement stream features. Positive long-term effects would include restoration of

riparian and aquatic habitat, improvement of vegetative cover through planting and/or grazing exclusion, and restoration of historically perennial stream reaches.

Cumulative Effects

The geographic setting and the timeframe for cumulative effects analysis for Alternative 2 is the same as described in Alternative 1.

Overall, the total amount of ground disturbance from past and present activities would be about 2,040 acres within the cumulative effects analysis area which equates to about 3% of the cumulative effects analysis area. This proposed action would add approximately 1,020 to 1,930 acres of ground disturbance for a cumulative total of approximately 3,060 acres to 3, 970 acres of ground disturbance from past, current and proposed treatment activities within the cumulative effects analysis area, which equates to approximately 4-5% of the cumulative effects analysis area. This combined cumulative ground disturbance would likely have little or no effect on water quality, especially given the lack of perennial streams in the area.

The recovery from ground disturbance associated with past wildfires and prescribed burns occurring within the affected watersheds is likely to be well underway with the positive effects of prescribed burns moving watersheds in the direction of improved conditions (i.e., decreased likelihood of stand-replacing fires). Mitigation measures that would be implemented under the proposed action would minimize adverse effects to the watersheds and treatment activities would improve watershed conditions through the restoration of two springs, obliteration and closure of roads, and reduction in fuels loading (Chapter 2). Therefore, the net cumulative effect from the proposed action would be positive and watershed conditions would be moved in the direction of Forest Plan standards and guidelines for watershed improvement (USDA FS, 1987).

Recreation and Scenery Management

Affected Environment

Types of recreation activities enjoyed throughout the project area in the spring, summer, and fall include dispersed camping, hiking, mountain biking, backpacking, horseback riding, trail running, motorized trail riding (motorcycles, ATVs, UTVs), hunting, target shooting, and pleasure driving to view scenery and wildlife. In addition, there are many different recreation special-use activities permitted within the project area including the annual American Cancer Walk along Snowbowl road (FR 516), weddings (near Aspen corner located adjacent to FR 516), bicycle events on FR 516, and large group campouts (i.e. Boy scout or various church organizations) near Wing Mountain, etc.

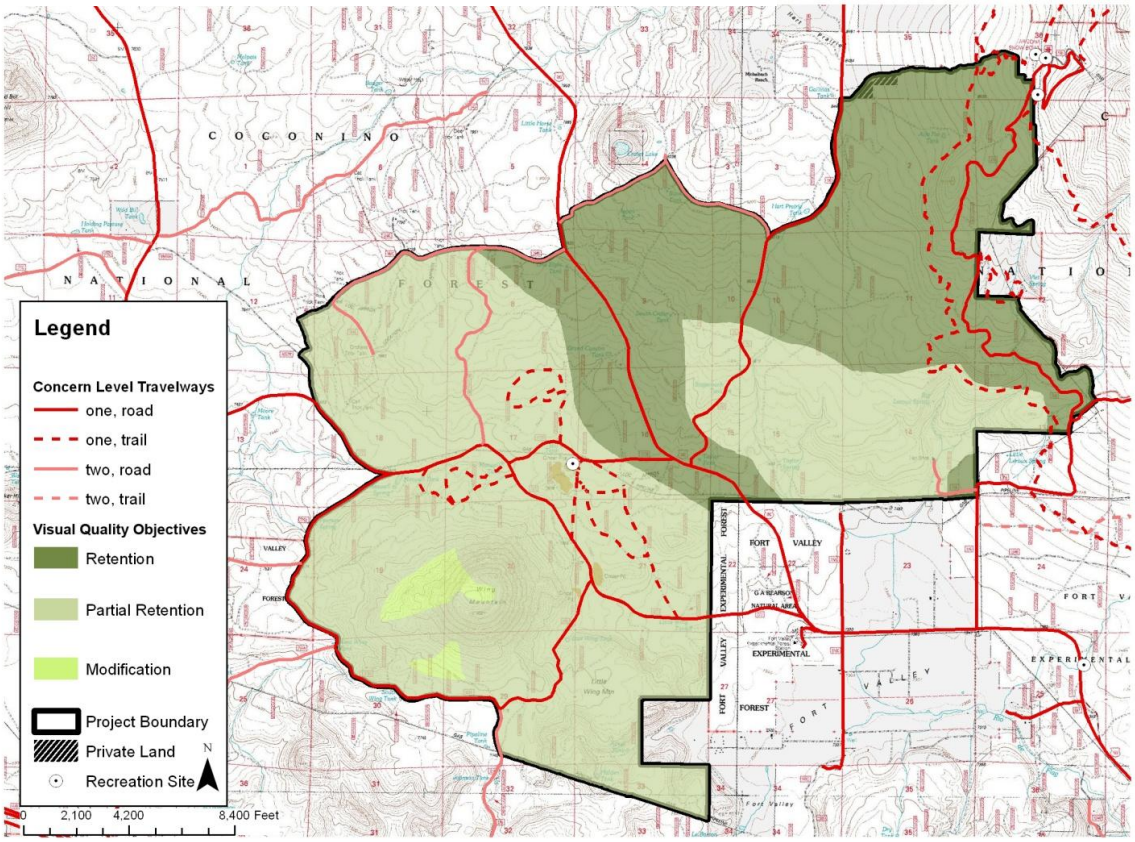
The assessment of scenic impacts for this project integrates the two analysis frameworks of the Visual Management System and Scenery Management System. In the Visual Management System (VMS), scenic quality is classified by Visual Quality Objectives (VQOs) that have been identified for different areas of the forest. VQOs are identified and determined in the Forest Plan and are developed through a combined analysis of the public's sensitivity and concern for scenic

quality and the diversity of natural features which appear in a particular landscape. They describe the degree of alteration that is acceptable within an area that is being managed.

Table 28: Visual Quality Objective definitions and occurrence in project area

VQO	Definition	Acres in Wing Mountain Project Area
Preservation	Only ecological changes are allowed in this Visual Quality Objective. Management activities are prohibited (except for very low impact recreation facilities).	**0 acres**
Retention	Retention refers to areas in which management activities are *not visually evident.* Activities may repeat form, line, color, texture, but changes in their size/pattern, etc are not evident. Any alteration to retention should be rectified immediately, either during or right after activity; i.e. Seeding disturbed areas or constructing access roads so they are not visible.	**~ 4,218 acres are Retention.** Highway 180 corridor and Snowbowl Road 516, & the northeast area of the project area.
Partial Retention	Management activities appear *visually subordinate* to the landscape. Activities can repeat form, line, texture but changes remain visually subordinate Project area must be returned to partial retention VQO as soon as possible once project is complete, at a minimum within the first year.	**~ 6,723 acres are** The majority of the project area is Partial Retention.
Modification	Management activities may dominate the landscape, but when viewed from afar as background, must appear to be natural. Reduction of activity appearance must be accomplished within first year, or meet regional guidelines.	**~183 acres** Modification VQOs exist around Wing Mountain only.
Maximum Modification	Management activities may dominate the landscape, but when viewed as background, must take on natural appearance of surrounding landscape. Time frame: contrast must be diminished within 5 years.	**0 acres**

Figure 10: Existing Visual Quality Objectives as they occur within the project area



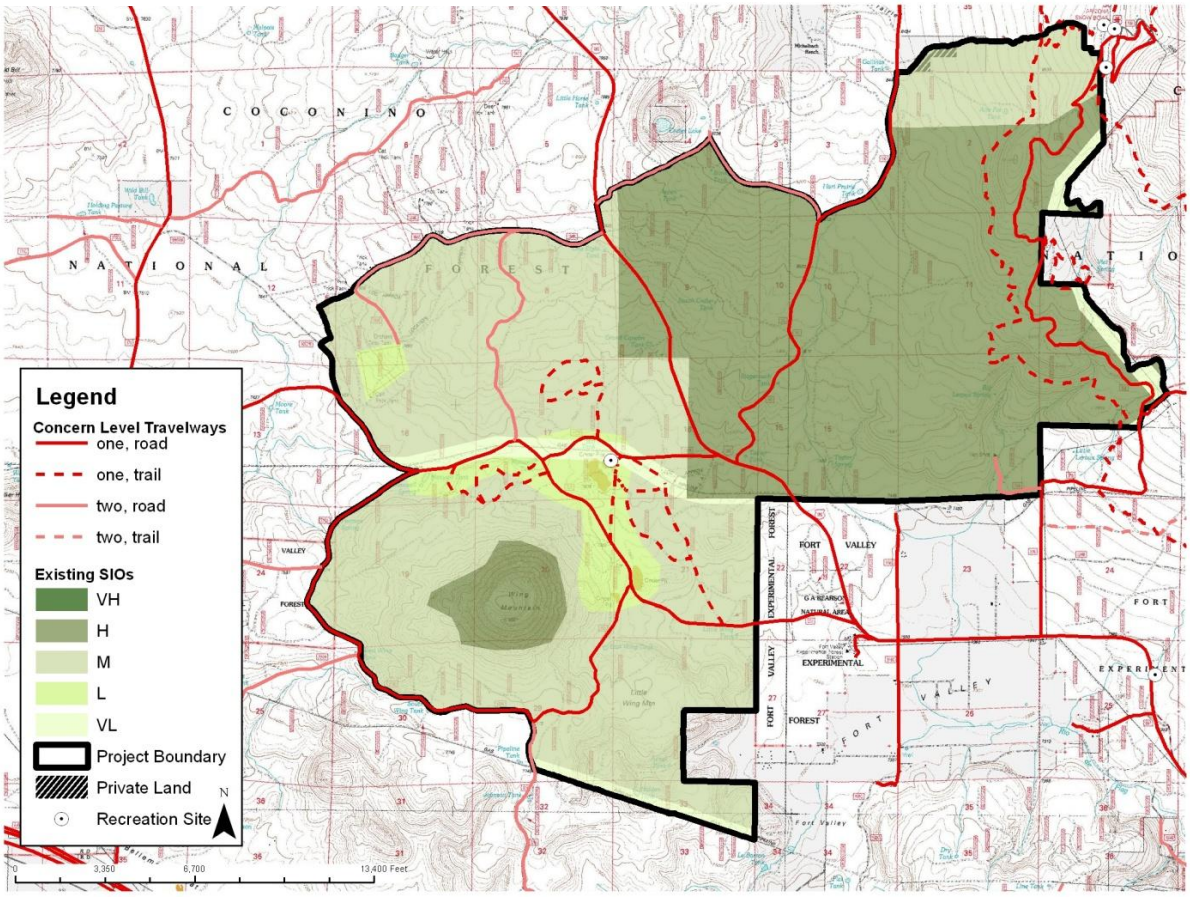
Scenic Integrity Objectives (SIOs) are used in the Scenery Management System in much the same way as VQOs are used in VMS (Table 29). The Scenic Integrity or "intactness" of national forest lands is the means by which proposed alterations to the land are evaluated. Scenic Integrity is produced from the combined inventory of scenic attractiveness, taking into consideration landscape character, viewing distance from the observer, and concern level of forest visitors (Table 29). SIOs range from Very High, meaning the landscape character is unaltered, to Very Low, meaning the landscape character is highly altered.

Table 29: Scenic Integrity Objectives (SIOs) Definitions and Occurrence in Project Area

SIO	Definition	Existing SIO Acreage	Desired SIO Acreage
Very High	Refers to landscapes where the valued landscape character is intact with only minute if any deviations. The existing landscape character and sense of place is expressed at the highest possible level.	0	**14.4**
High	Refers to landscapes where the valued landscape character appears intact. Deviations may be	5036.5	**8822.8**

SIO	Definition	Existing SIO Acreage	Desired SIO Acreage
	present but must repeat the form, line, color, texture, and pattern common to the landscape character so that changes are not evident.		
Moderate	Refers to landscapes where the valued landscape character appears slightly altered. Noticeable deviations must remain visually subordinate to the landscape character being viewed.	5196.3	**2305.8**
Low	Refers to landscapes where the valued landscape character appears moderately altered. Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes outside the landscape being viewed.	525.2	**0**
Very Low	Refers to landscapes where the valued landscape character appears heavily altered. Deviations may strongly dominate the valued landscape character. They may not borrow from valued attributes within or outside the landscape being viewed. However deviations must be shaped and blended with the natural terrain (landforms) so that elements do not dominate the composition.	385.1	**0**
Unacceptably Low	Refers to landscapes where the valued landscape character being viewed appears extremely altered. Deviations are extremely dominant and borrow little if any form, line, color, texture, pattern or scale From the landscape character. Landscapes at this level of integrity need rehabilitation. This level should only be used to inventory existing integrity. It must not be used **as** a management objective.	0	**0**

Figure 11: Existing SIOs as they occur within the Wing Mountain project area



The project area is bordered to the east by the Kachina Peaks Wilderness, and the main corridors which access the project area are Highway 180 and FR 516 (Snowbowl Road). There is one developed recreation site within the project boundaries, Wing Mountain Snowplay Area, as well as a children's educational camp run by the Flagstaff Unified School District, Camp Colton. The project area contains approximately three miles of the Arizona Trail, which links Utah to Mexico and is one of the nation's most popular recreation trails. There are other forest trails in the project area as well. There are a number of user-created, non-system motorized trails within the projects area that are closed under the Travel Management Rule decision (September 2011), which also prohibits unauthorized off-road travel. Recreation activities which occur in the project area include scenic driving, trail use, mountain biking, picnicking, snowmobiling, cross-country skiing and snow play.

As noted in Table 29, 14.4 acres of the project area are classified with a desired SIO of Very High. Very High SIO areas (preservation) are in the far east portion of the project area, bordering the Kachina Peaks Wilderness. The project contains 8,828.8 acres of desired High SIO (retention) areas, which include Highway 180, Snowbowl Road (FR 516), and FR151. Highway 180 and Snowbowl Road are identified in the Forest Plan as being managed with a VQO of

Foreground Retention (Forest Plan defines this as 300 feet either side of the road). Trails within the project area classified completely as High SIO are:

- The Arizona Trail, 5 miles of which are within the project boundary. This trail was designated a National Scenic Trail in March 2009, and is a high use recreation corridor, for non-motorized multi-use such as hiking, mountain biking, and cross-country skiing.
- Aspen Loop Trail

The Kendrick Snowmobile and Cross Country Ski Trails occur within both High and Moderate SIOs. There are approximately 2306 acres of Moderate desired SIOs within the project area. This area includes portions along the length of the existing pipeline, areas around the cinder pits, and in the northwest and southern sections of the project area. No areas of Low, Very Low, or Unacceptably Low appear in the project area, as they are not desired Scenic Integrity Objectives.

Concern levels have also been identified for the area. Concern Level 1 include: Highway 180, FR516 (Snowbowl Road), FR151 (Hart Prairie), FR222A, FR222B, FR222, FR519, and FR522. Concern Level 1 trails include the Arizona Trail, Aspen Loop Trail, the Kendrick Snowmobile and Cross Country Ski Trails.

The Wing Mountain project area's desired Scenic Integrity (the degree to which the existing scenery is free from visible disturbances that detract from the natural and socially valued appearance) from inventoried sensitive viewpoints is mostly High (retention) to Moderate (partial retention) (Figure 14). Desired conditions for the project area are that overall the landscape appearance is one of being only *Slightly Altered* or less.

The Seen Area Analysis indicates the most sensitive areas and levels of visibility within the project area. Visibility is mapped from each travelway, with foreground, background, middleground, and seldom seen areas identified. Concern Level 1 Foreground contains the highest visibility. The majority of the project area is seen as Concern Level 1, with a total area of 7065.39 acres. For more information on Seen Area Analysis, see the Scenery Management Specialist Report in the project record.

Landscape Character is "[…] a combination of physical, biological, and cultural images that gives an area its visual and cultural identity and helps to define a 'sense of place.' Landscape character provides a frame of reference from which to determine scenic attractiveness and to measure scenic integrity (FSM 2380, pg. 10)." The project area occurs approximately 50% in the Ponderosa Pine subzone and the other remaining 50% in the San Francisco Peak subzone. These two subzones are distinguished by desired landscape character elements of dominating ponderosa pine vegetation interspersed with mixed conifer and aspen stands, old growth "yellow belly" ponderosa pine, mountain meadows/grasslands, and striking mountain landforms.

Views from Highway 180 and FR 516 reveal that there has been some thinning activity prior to the Wing Mountain Project as evidenced by stumps and slash. In addition, there is evidence of motorized cross country travel in some places. The corridors along Highway 180 and FR516 are dominated by areas of densely-packed, thick stands of trees, locally referred to as 'dog hair thickets' (Figure 12). These 'dog-hair thickets' create negative, undesired, homogenous visual impacts. They limit views into a forest for people traveling along the road corridor, and are devoid of diversity and variation.

Figure 12: Dog hair thicket along Highway 180, looking east

Long term objectives of this project for forest health coincide with long term objectives for scenery. Restoring portions of the landscape to conditions that reflect the historic range of variability would benefit scenic quality. Desired conditions for scenery include a natural-appearing, fire-adapted ponderosa pine ecosystem, with open, park-like stands, large mature trees as well as a clumpy distribution of trees of varying ages and sizes, presence of aspen and meadows, and an herbaceous, diverse understory. The desired landscape appears natural and unaltered to the casual forest observer and meets scenic integrity objectives.

Many of the desired qualities for forest health are also valued as scenic attributes (Ryan 2009). These qualities include large trees, "yellow belly" old growth trees; park-like stands which provide filtered views into the forest and therefore more intrigue and visual access; and a varied understory which provides contrast to the prominent lines of the forest's trees. Some thinning has occurred within the project area prior to the planning of the Wing Mountain Project, and these areas either meet existing conditions or are moving toward the desired landscape character objectives for the Forest.

Environmental Consequences

This section describes the direct, indirect, and cumulative effects of implementing each alternative on the scenic resources within the project area. Deviations from the aesthetic appeal and desired landscape character are disclosed as direct and indirect effects for each alternative.

Analysis is evaluated on the basis that the project area is most often viewed at distances of 300 feet (immediate foreground) from Concern Level 1 travelways and developed sites, where scenery is dominated by the forest canopy and understory. However, some of the project area is visible from above when viewed from high viewpoints adjacent to and west of the project area. The effects of the alternatives on scenery are described in a narrative format. Project activities are measured against how they would change and visually disturb the scenery. The project alternatives are summarized as to how they would change the existing and desired scenic integrity and scenic attractiveness and for how long those changes would be evident. The evaluation of effects is largely qualitative.

Alternative 1: No Action
Direct, Indirect and Cumulative Effects

No action within the project area would mean that no fuels treatment or management activities would occur. No thinning of forests fuels, encouragement of aspen regeneration, spring restoration, or meadow enhancement would take place. The existing Scenic Integrity Objectives within the project area would be met, with no human-caused impacts to scenery resulting from management activities. However, visual quality within the project area would continue to decline over time. The forest within the project area is currently dominated by stands of even-aged, dense ponderosa pines, with multiple 'dog-hair thickets' and closed canopies, and this trend would continue if no action occurs. Current conditions of the project area are such that tree density limits views into the forest and special features such as lava flows, aspen stands, lichen covered rocky outcrops, meadows, and grassy draws are not usually visible through the heavy tree cover. If no action occurs, this lack of visual diversity would increase and views into the forest would decrease further from current conditions; there would be no opportunity to increase or enhance scenic resources or move towards the project's desired conditions.

If no fuels treatments occur, the project area would continue to be vulnerable to the threat of high severity wildfire. If such a fire were to occur, the SIOs of the project area would be met, because fire is considered a natural part of the ecosystem. However, the current state of the project area is such that if a high intensity (stand-replacing) wildfire took place, the fire would reshape the existing landscape character. Existing landscape character and desired landscape character would not be met until vegetation fully recovered.

In the short term following a high intensity wildfire, expansive areas of bare soil would be evident, areas of intensive erosion and soil movement could occur, and invasive species and spotty underbrush would appear in the disturbed soil until re-establishment of native species was complete. In the time that the vegetation was recovering, many blackened, dead, bare trees would dominate the landscape, and if they were to fall they would contribute to undesired and dominant forest litter. The forest's character would be open and patchy as opposed to dense, but the overstory and canopy of the forest would be drastically reduced and potentially eradicated. In the long term, blackened dead trunks would remain standing, and full-growth trees with canopy cover would take decades to reappear.

High severity wildfires tend to result in an initial negative reaction from the public, as large blackened landscapes are generally not preferred and are not considered part of the natural scenery. In addition, emergency post-fire actions and fire lines would create unnatural appearing scars within the landscape; within 2 to 3 years the impact of these activities would be mitigated as forbs, wildflowers, and grasses reappeared. Within 5 years, visible signs of recovery within the

forest landscape would be evident, such as understory, saplings, and reduction in bare soil; however the long term impacts of a high intensity fire would delay the ability of the project area to meet desired conditions.

Since there would be no direct effects from this alternative, there would be no cumulative effects.

Alternative 2: Proposed Action
Direct and Indirect Effects

The proposed treatments overlaid on the existing Scenic Integrity Objectives are shown in Figure 13, and the proposed treatments overlaid on the desired Scenic Integrity Objectives are shown in Figure 14. This analysis will disclose the effects to the existing SIOs from the proposed actions and analyze those effects in relationship to desired, long term conditions, i.e. desired SIOs.

The proposed action calls for treatment of a total of 10943 acres of the 11,143 acre project area. These treatment methods include mechanical thinning followed by prescribed fire (approximately 10,366 acres or 93%), prescribed fire only in certain areas (577 acres), hand thinning, fencing (for aspen regeneration and spring restoration) and other aspen regeneration methods including jackstrawing, conifer removal, partial cutting, ripping and planting (see Proposed Action).

The Forest Plan allows for short-term visual impacts, provided that those impacts are promptly rectified after project completion and that these impacts lead to long-term scenic quality: "Provide fast clean-up from management activities and limit short-term visual impacts (1 to 3 years), while meeting fire potential reduction needs, design thinning for long-term scenic quality adjacent to homes and along major highways or near developed recreation sites" (CNFFP Amendment 17, pg. 323).

Scenic integrity objectives allow for "An interim or short-term minimum level necessary to reach a long-term character goal" (SMS, 2-2). Using this direction, interim Scenic Integrity Objectives have been assigned for the duration of project implementation (1-3 years) according to SMS handbook direction (USDA Forest Service, 1995. FSH No. 701, pp. 2-2). Proposed mitigations are intended to reduce impacts to the scenery resource and ensure the project meets or exceeds existing Scenic Integrity Objectives at the end of implementation (see Chapter 2). Generally speaking, as a result of the Proposed Action Alternative, viewers would see a more open landscape, an increase in sunlight to the forest understory, and a greater visual penetration into the understory as a result of the proposed activities. The treatments in the Proposed Action Alternative would move the forest towards the desired landscape character and desired Scenic Integrity Objectives. The generalized prescriptions, treatment types and associated actions as they relate to scenery are described below.

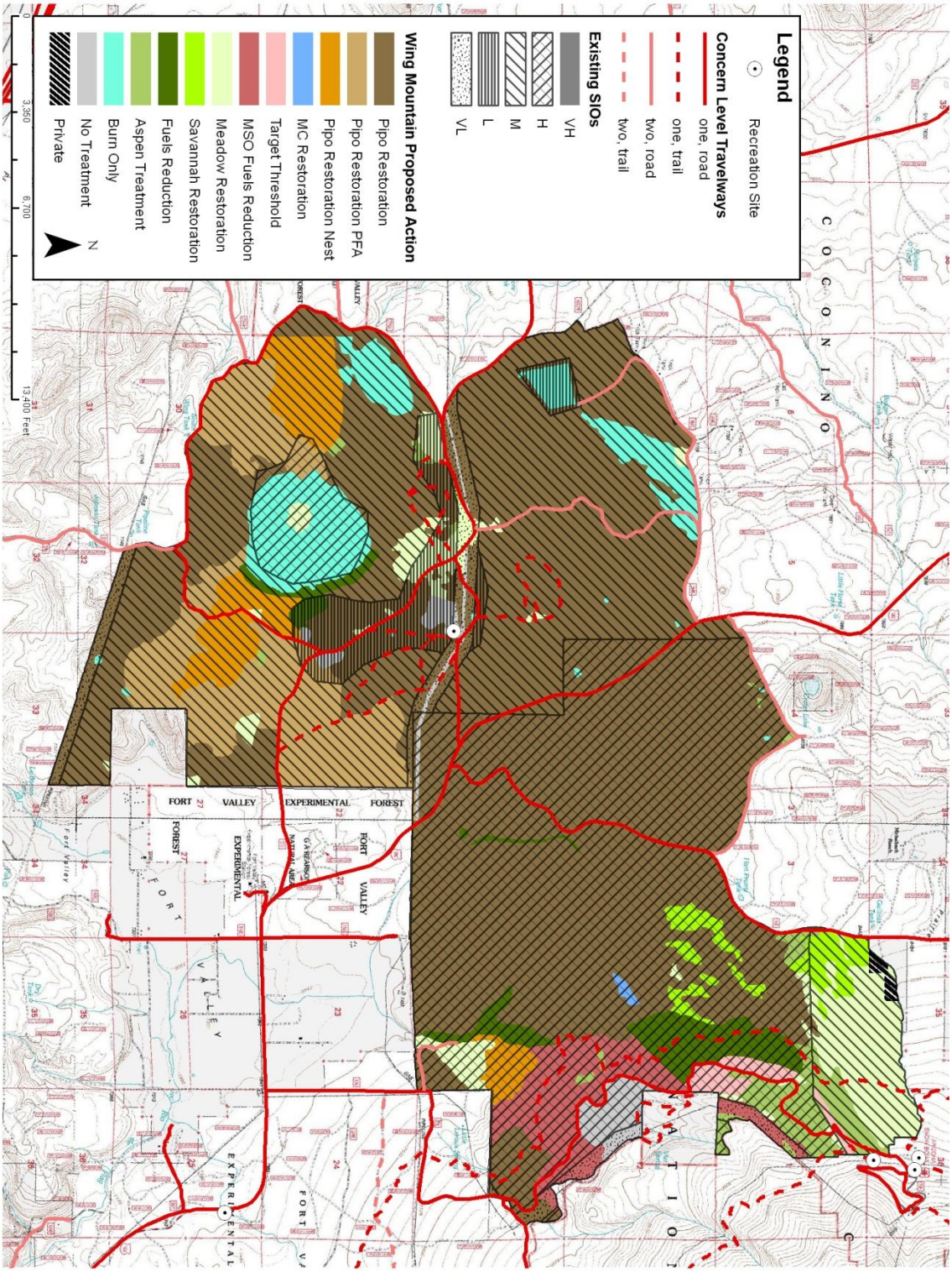


Figure 13: Existing SIO and Proposed Action Treatments for Wing Mountain project area

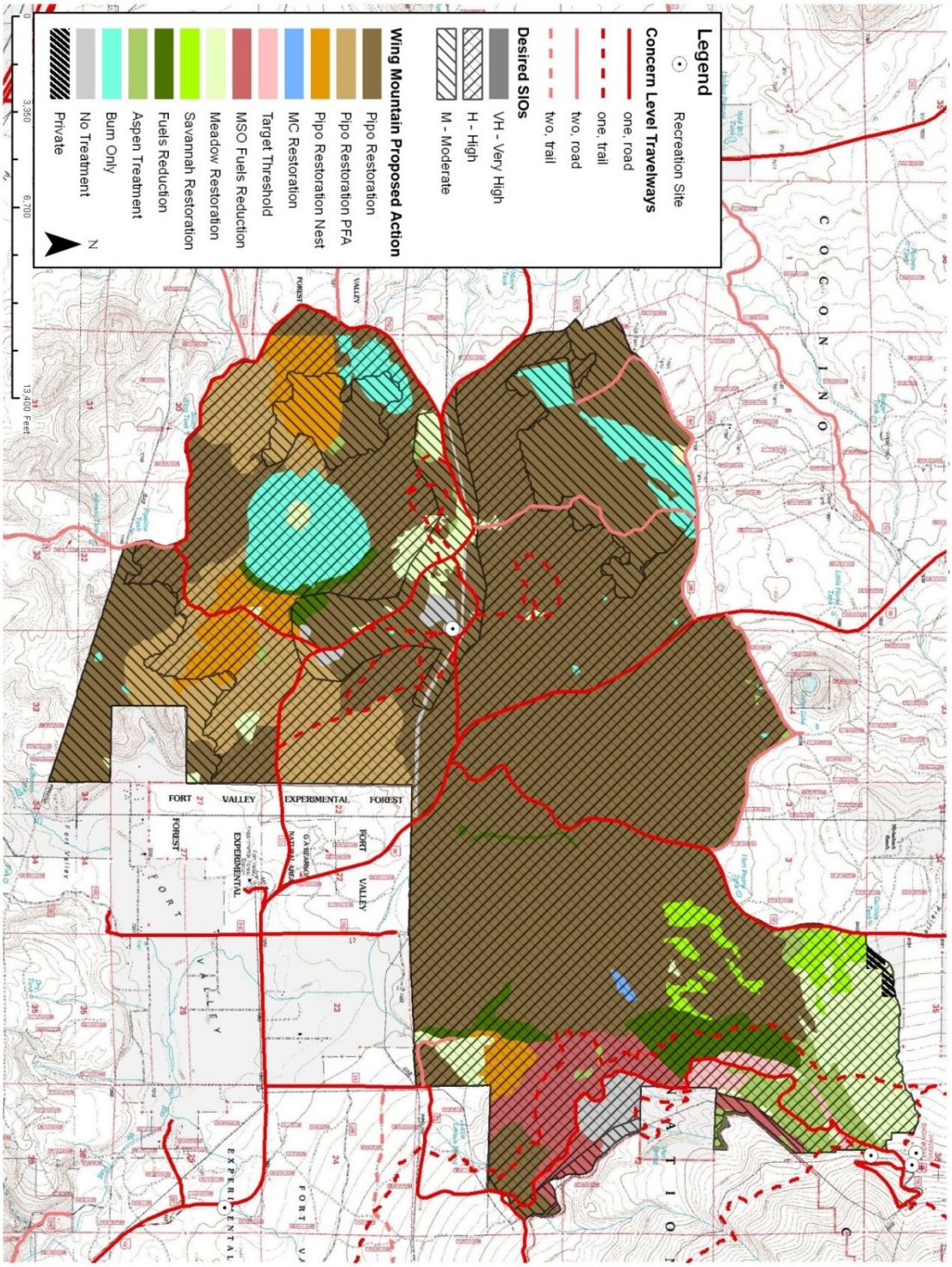


Figure 14: Desired SIOs and Proposed Action Treatments for the project area

Mechanical Treatments

The proposed action calls for machine and hand piling and prescribed burns on approximately 93% of the project area, following mechanical treatment. Of these approximate 10,366 acres to

be machine piled and burned, 6,650 acres are within the foreground of Concern Level 1 travelways. Mechanical treatments and subsequent prescribed burns would occur within the foreground of all the Concern Level 1 travelways in the project area.

Mechanical treatments include, but are not limited to: use of chainsaws or feller-bunchers to cut trees and lop slash, skidders to move material to landings, bulldozers to pile slash, and specialized equipment such as feller-buncher or track-type hot saws, and tree shears to cut, chop, break, and lop fuel material. Some areas would be hand-thinned using chainsaws only due to resource concerns such as sensitive soils. In these areas, slash would be hand piled without the use of heavy machinery.

There would be a slight to moderate effect on scenic quality during and immediately following implementation of these treatment methods (1-3 years for mechanical treatment). If used, the track-type hot saw would have less ground impacts than other equipment since it sits in one spot to operate. Where this equipment has been used on other projects, typically stumps are cut flush unless prevented by rocks or other natural features.

The presence of skid trails, landings, stumps, and piled or scattered slash would also result in a moderate reduction of the scenic quality for the duration of the project. The effects in these areas would not be long-term since skid trails would be rehabilitated and activity generated slash would be removed upon completion of the project. In areas using machine piling (the majority of the total project area), large machine piled slash would be visible at landings immediately following thinning. Per the fire and fuels report, the piles are expected to be burned usually within a year of pile construction to allow sufficient time for the newly cut fuels to dry out; until then, piles would dominate the scenery at the landings. Machine piling also often leads to surface disturbance and destruction of ground covers. Disturbed ground cover would also appear visually evident to the casual observer traveling along Concern Level 1 roads and trails. The ground disturbance resulting from using machines to pile slash would be noticeable for at least 1 year after project completion, depending on how quickly the areas were rehabilitated and vegetation regenerated. An interim SIO of Low is assigned to those areas within the 300' immediate foreground of Concern Level 1 travelways containing landings with large piles or visible temp roads until implementation is complete, the piles are completely burned, and ground disturbance is restored. Proposed mitigations such as landing, temp road, and trail rehabilitation, flush-cut to low stump heights, and prompt treatment of slash ensure that treatments meet prescribed SIOs in the long-term.

The resulting forest structure would be clumpy groupy, with openings and uneven-aged managements with a reduction in canopy cover of 40% and 20% created canopy openings.

Prescribed Burning

Initial Burn

Prescribed fire would result in short-term, moderate reduction in scenic quality. Depending on fire severity, short-term visual distractions would include smoke, burn scars, blackened or scorched understory, burnt soil, and dead and dying vegetation from the prescribed burn. Prescribed burning has potential to occur throughout the calendar year, dependent on moisture conditions of fuels and weather patterns. Arizona Snowbowl may be impacted by smoke from burning activities, depending on wind and ventilation conditions; the impact may be greater when burning occurs south/southwest of the Snowbowl area. Short-term impacts of smoke are lack of visibility and obscuring of scenery, and are temporary. Smoke from a prescribed burn occurs

only for the duration of the burn, and the smoke produced from a prescribed burn results in low intensity smoke that dissipates into the atmosphere. Comparatively, smoke from a high-intensity wildfire can heavily impact an area's air quality and visibility for weeks and months.

The US Forest Service follows all state and federal air quality laws, and burning typically occurs when ventilation is rated as good or excellent and transport winds are occurring in a direction that moves smoke away from sensitive areas and/or Class 1 airsheds. As part of standard Forest Service operations, a burn plan would be created for the project that would consider wind direction, atmospheric stability, and duration of burns to avoid smoke sensitive areas. This burn plan would also consider high visitor-use periods. Smoke impacts to the ski area would occur, but would be mitigated by following these guidelines during implementation. Over the long term, use of prescribed fire and other treatments identified in the project would result in a more varied forest structure with desirable visual characteristics such as open park-like stands, views into the forest, and species diversity.

Pile burn
This management prescription would occur prior to initial entry prescribed burning as a method for removing slash produced from thinning activities. This clean-up burn is essential for improving the aesthetic acceptability of these areas. The burned area following initial burns of slash piles would not recover immediately; it often takes 3-8 years for native vegetation to become established due to some soil sterilization following burning. Following burning, small amounts of blackened, partially burned materials would still be visible, and some trees near the burned piles are expected to be singed. There would be small pocked areas of tree mortality resulting from tree singe adjacent to some piles. Once piles are burned, these areas would meet existing SIOs. The desired SIOs of High would only be met within the immediate foreground of Concern Level 1 roads, trails, and recreation sites within the project area when all slash piles have been treated through burning, all residual material has been removed after pile burning, and vegetation within disturbed ground areas has begun to reestablish. In the long-term, these treatments would lead the project area to the desired conditions for scenery, creating a more visually acceptable forest stand and improvements to species composition and diversity that is overall compatible with desired scenic character.

Maintenance burn
Maintenance burns would take place to mimic natural return intervals every 3-7 years depending on fuel accumulations. The low to moderate intensity maintenance burns would result in the consumption of surface litter, logs and mortality of small groups of trees. Smoke would be visible during the burning operations. Post burning, blackened soil, trunks, dead or dying vegetation, or partially burned slash, dead and downed trees would be visible. The maintenance burn would promote a more open understory, a preferred landscape aesthetic. Following prescribed burning, the understory grass and shrub vegetation would become noticeable after one to two growing seasons. Long term improvements in soil and vegetation health would encourage a more sustainable stand of forest allowing for improved visual qualities.

Temporary Roads and Improvements
Existing roads would be used to the extent possible for hauling harvested trees. Forest Roads (FR) 151A, 222, and 171 would be used as main haul routes. FR 519 would be reconditioned, including all drainages, and resurfaced from FR 222 to FR 518 using material from Riordan Pit. FR9232R would also be reconditioned. Snowbowl Road (FR516) may be used as a haul route; however no log truck traffic would be allowed when Snowbowl Ski Resort is open for ski season

or during permitted special use events using Snowbowl Road. The construction of approximately 3.25 miles of temporary roads is anticipated in order to access the entire project area, with post-project decommissioning planned. These roads would not be added to the forest transportation system and would be decommissioned after project was completed.

During road construction, vegetation would be cleared and pruned to accommodate trucks and other equipment, the road prism would be defined and surfaced with aggregate, and drainage features (e.g. rock-lined low water crossings) would be installed. Upon completion of the project, these temporary roads would be recontoured, ripped and reseeded, returning them to their original condition to the extent feasible. Effects associated with constructing these temporary roads would be very noticeable throughout the duration of the project in the immediate foreground and would diminish after the roads were decommissioned. The overall effect on the scenic quality would be slight to moderate. In addition, this project is proposing to decommission another 48.88 miles and obliterate 5 miles of existing roads identified as closed under the Travel Management Rule (2011) within the project area. This would improve scenic attractiveness in the immediate areas, and would slightly improve the scenic integrity in the area.

High Viewpoints
Some of the proposed treatments may be visible during the short-term, project implementation period from surrounding high viewpoints adjacent to and west of the project area. These popular high elevations viewpoints include the Arizona Snowbowl ski area, the Hart Prairie lodge, and high-elevation trails such as Humphreys and Weatherford Trails. Those treatments visible from this perspective may include prescribed burns and associated smoke, temp roads and landings, but are all short-term and would be visible only during project implementation. Long-term effects of the Proposed Action would increase scenic quality as viewed from long distances at high elevations; forest would appear more open with varied structure and density.

Ponderosa Pine Restoration
Foraging Areas
Of the total 7079 treatment acres, 58% is seen as Foreground Concern Level 1 (4135.89 acres). This treatment would occur within the majority of the corridor of CL 1 travelways Highway 180, FR151, FR222, 22A, 222B, Kendrick trails, and portions of FR516, FR519, and the AZ Trail. Effects from mechanical thinning, machine piling, and prescribed fire, would apply to these treatment acres (as described on page 32-34).

Stands treated under this prescription would be more open than in MSO habitat areas and would be managed for uneven-aged characteristics. Treated stands would appear more visually and spatially diverse when compared to existing conditions.

PFA Habitat Stands
Of the total 959 treatment acres, 69% is seen as the foreground from Concern Level 1 travelways (661.67 acres). This treatment would be visible within the foreground of the Pipeline Kendrick snow trail, FR222, FR519, and the southern section of Highway 180. Effects from mechanical thinning, machine piling, and prescribed fire, would apply to these treatment acres. Again, treated stands would be more reflective of preferred scenic landscapes when compared to existing conditions.

Northern Goshawk Nest Areas

Of the total 456 treatment acres, 65% is seen as the foreground from Concern Level 1 travelways (295.53 acres). This treatment would be visible in the immediate foreground of portions of FR519 and may be visible as distant foreground from the AZ trail. Effects from mechanical thinning, machine piling, and prescribed fire, as described above, would apply to these treatment acres. Treated stands would appear virtually unchanged from existing conditions to the casual forest visitor.

Mixed Conifer
Of the total treatment acres, 79% is seen as the foreground from Concern Level 1 travelways (7.07 acres). Effects from mechanical thinning, machine piling, and prescribed fire, would apply to these treatment acres. Remaining forest structure would be clumpy groupy, with stands of varying sizes, shapes, and density, moving this area more towards the desired conditions for scenery.

Mexican Spotted Owl Treatments
Restricted Target Threshold
This treatment proposes to use mechanical thinning followed by prescribed burning, using thinning from below methods to reduce fuel ladders and loading. Of the total 82 target threshold treatment acres, 89% (75.63 acres) is seen as the foreground from Concern Level 1 travelways. These treatments would most likely only be visible within the immediate foreground of FR516 and the AZ Trail; however, the delineation of treatment type would most likely not be visible in the immediate foreground of the AZ Trail, since it occurs far beyond the 300' immediate foreground distance. Effects would be localized to the immediate foreground of FR516 only.

Effects from mechanical thinning, machine piling, and prescribed fire would apply to these treatment acres. Emphasis on thinning from below to reduce fire hazards and mimicking natural disturbance patterns with irregular tree spacing and various patch (opening) sizes would promote the desired naturally appearing landscape and is generally compatible with prescribed SIOs. Large trees (>24 inches dbh) would be not be harvested in this prescription which is consistently recognized as a preferred aesthetic. The overall reduction of trees per acre would result in a more open landscape over time (based on stand modeling reduction from approximately 966 to approximately 505 of trees per acre).

Mexican Spotted Owl Protected Activity Center (PAC) Treatment
During project implementation, machine piles and post-thinning burns would have effects on scenery. Of the total 392 treatment acres, 89% (350.03 acres) is seen as the foreground from the following Concern Level 1 travelways: FR516, the northern portion of FR151, and the AZ Trail. Treatment methods include both mechanical and hand thinning followed by prescribed fire; in those areas where hand thinning occurs, the scale of the piles should be reduced and thus be less visible.

Both Treatments
In those areas that are machine piled following whole tree harvesting methods, slash piles would be larger and visible to the casual observer. Mitigation measures ensure that log decks are minimized along CL1 travelways, and in areas where they are unavoidable within the 300' immediate foreground of CL1 travelways, the landings would be rehabilitated immediately following project implementation. An interim SIO of Low would be assigned to those areas with this treatment type where log landings are visible from CL1 travelways during project implementation; when piles are burned and landings are rehabilitated, prescribed SIOs would be

met. Over time, these treatments would result in stands appearing slightly more open and more diverse over time when compared to the existing condition, although the difference may not be noticeable to the casual forest visitor, particularly when driving along the roads.

Meadow and Grassland with Pine Savannah Restoration
Natural meadows would be restored through the removal and clearing of all encroaching conifers. This treatment would use hand and mechanical thinning, followed by pile and broadcast burning; therefore effects from mechanical thinning, machine piling, and prescribed fire would apply to these treatment acres (as described on page 32-34). Of the total 792 acres of meadow and grassland restoration, 79% (627.25 acres) is seen as the foreground from the Concern Level 1 travelways FR151, FR222, FR519, and all trails within the project area. The majority of the restored meadows are located in areas with existing SIOs of Moderate or lower, with the remaining occurring in areas with an existing SIO of High. This treatment would produce the significant result of moving these areas to desired SIOs of High and Moderate, by reintroducing a valued scenic element back into the landscape and sustaining it over time.

Fuels Reduction Thin from Below
The majority of this treatment would be hand thinning due to the presence of steep slopes with sensitive soils and inoperable boulder fields, though some small areas of thinning may utilize machinery. Of the total 325 treatment acres, 78% is seen as the foreground from Concern Level 1 travelways (252.63 acres). CL 1 travelways within this treatment type are FR516, FR222, FR519, the central portion of the AZ Trail, and the southern Kendrick trails. Due to the nature of hand thinning, larger trees would likely not be cut because they cannot be moved by hand easily. This would result in effects from this treatment mostly being seen only in the foreground of the AZ Trail; all other concern levels travelways are at such distances that this particular treatment would most likely not be evident. The impact to scenery during implementation would be minimal as hand thinning produces smaller piles than mechanical treatment would. Mitigation measures ensure that slash piles would be pulled 300' back from the immediate foreground where possible, and that the slash would be burned when they have sufficiently dried out to burn. Some post-burn effects may be visible, but would be localized and would recover in 3-8 years. An interim SIO of Low (modification) would be assigned to these areas during treatment. Canopy gap and interspaces between tree groups would be created where possible up to 50' in diameter, resulting in stands which appearing slightly more open and more diverse over time when compared to the existing condition. The change brought about by these treatments may not be noticeable to the casual forest visitor, but SIOs would be maintained.

Burn Only
Areas proposed for burning only are the Pipe and Whitehorse fire scars, the old experimental clearcut, and Wing Mountain. Of the total 577 treatment acres, 42% is seen as the foreground from Concern Level 1 travelways (241.09 acres). The north, east, and south slopes of Wing Mountain, which contain an existing and desired SIO of High (retention), would be visible from Concern Level 1 travelways FR222, FR519, the Kendrick Snowmobile and Cross Country Ski Trails, and potentially FR222A due to the steep slopes of the mountain rising into view above the surrounding forest. Other burn only treatment areas would be visible in the foreground from portions of CL1 travelways Highway 180, FR222, FR222A, and FR222B. Burn only treatment activities occur within areas of the project that contain existing SIOs of High and Moderate, with a portion at the end of FR164C that occurs in Low. An interim SIO of Low (modification) would be assigned to these areas during treatment. This interim SIO would most likely last until the burned area's vegetation is completely recovered, usually within one growing season. The effects

in the Burn Only Treatment type are the same as the project-wide effects of prescribed fire. There is potential for some tree mortality resulting from the burn, but overall the effects of this treatment would move the area to the desired conditions, reducing fuel loading and raising crown canopy, which would allow for more views into the forest and eventual increase in diversity of the forest structure. Project acres in this treatment type would meet the desired SIOs of High and Moderate within the long-term.

Aspen Restoration
Of the total 272 acres of pure aspen treatment type identified, 90% is seen as the foreground from Concern Level 1 travelways (244.53 acres). CL 1 travelways from which this treatment type would be seen are the northern sections of FR516, FR151, and potentially the Aspen Loop Trail, northern and central portions of the AZ Trail, and isolated portions of FR222 and FR519. Aspen treatments would consist mainly of removing conifers from aspen stands and groups, using mechanical treatments such as ripping, planting, and cutting of aspen followed by prescribed fire. Some aspen stands or groups may be fenced or jackstrawed to protect regenerating aspen. Mitigation measures ensure that jackstrawing would not occur within the immediate foreground or viewshed of Concern Level 1 and Concern Level 2 roads and trails. Fencing would be the methods of aspen treatment to exclude elk from aspen and oak regeneration in these CL1 and CL2 viewsheds. There would be a slight, localized visual impact from the fence line while it is in place. This impact would be offset by the restoration of the aspens, an important visual element of the desired landscape character description. Following treatment, the overall amount of trees per acre would decrease, but the amount of aspen per acre would remain the same, and these aspen would be visible to forest visitors from Concern Level 1 travelways, providing year-round texture and color interest for fall foliage viewing. Overall, mitigation measures ensure that SIOs within this treatment type would be met during project implementation, and treatment would move these areas toward the desired SIOs of High and Moderate within the long-term.

Spring Restoration
Fencing may be constructed around Maxwell Springs and Big Leroux Springs to deter ungulates, encourage riparian vegetation growth, and protect the quality of the spring. Water would be released to restore and recreate the riparian area, providing new habitat for wildlife. There would be a slight, localized visual impact from the fence line while it is in place; however mitigation measures ensure that prescribed SIOs would be met and to ensure stability of scenic quality. This proposed action would have the added benefit of enhancing scenic quality around the springs in the long term, as the restored water features would provide increased wildlife viewing and overall scenic interest.

No Treatment
Approximately 200 acres are identified as no treatment in the proposed action; this includes 18 acres of private land, old borrow material pits, the Transwestern gas pipeline right of way, and sensitive wildlife habitat. Out of the 200 acres, 87% is seen as the foreground from Concern Level 1 travelways (174.06 acres). CL 1 travelways from which this treatment type would be seen are from the southern section of FR516 (this treatment type would occur directly adjacent to parts of the road), isolated portions of FR222 and FR519, and potentially from FR222B, FR151, and the Kendrick Snow Trails. The effects of no treatment would mean that no thinning of forests fuels would take place in these identified acres. The existing Scenic Integrity Objectives within 182 of the 200 acres would be met, with no human-caused impacts to scenery resulting from management activities. However, these isolated areas of the project would not move towards desired conditions and desired scenic integrity objectives. Areas which contain old

borrow material pits would not change from current conditions. Areas with existing stands of even-aged, dense ponderosa pines with closed canopies would continue to dominate the landscape. These effects would be particularly noticeable along FR516, as the no treatment acres would occur directly adjacent to this highly traveled road.

Discussion

The proposed action would result in a forest that more closely reflects the natural range of variability and desired conditions for scenery. Scenic quality would be enhanced as the diversity of tree species, size, and spatial distribution increased. Throughout much of the project area, stand density would be reduced. The views along major use roads Highway 180, FR516, and FR151 would be more diverse. Visitors traveling along these corridors would experience a sequence of enclosures and openings that add variety and afford more expansive views into the project area. Natural meadows would be restored and aspen stands regenerated, which would increase visual diversity and place more emphasis on these valued scenic features. Stands would feature clumped, uneven-aged groups interspersed with openings. The understory component of shrubs, grasses and forbs would develop and respond to the open canopy conditions, further increasing visual diversity. Overall, scenic interest and resources would be improved in the project area through implementation of the proposed action treatments.

Cumulative Effects

Cumulative impacts for scenery include the impacts from past projects in addition to the impacts of the proposed project as well as impacts from foreseeable future projects. The time limit for considering cumulative effects is the reasonably foreseeable future, which equates to about 20 years. The boundary for determining cumulative effects is the project area itself; however cumulative impacts may also occur from other recent projects outside of the proposed project area but within the viewshed of sensitive travelways within the project area. Past and present activities that created the current existing conditions include grazing, the evolving forest management practices related to timber harvest and fire suppression, drought, forest restoration, developed and dispersed recreational use and associated developments, and private land in-holdings.
By improving the health of the forests within the project area through reduction of existing vegetation density, this alternative would combine cumulatively with other restoration projects past, present, and future within the immediate project area, specifically the A-1, Fort Valley, and Hart Prairie restoration projects (which are in various stages of implementation), and the planned Four Forest Restoration Project (4-FRI) fuels reduction and forest project. The cumulative impact of these combined projects would reduce the threat of severe wildfire in the long term. The reduction of existing vegetation density from these restoration projects would result in the long term in a forest structure closer to desired conditions for scenery. Another ongoing project within the project area, the Tornado Recovery Stewardship Contract, intends to remove damaged trees and hazard fuels from recent tornado destruction; this project would also combine cumulatively with the Wing Mountain proposed action to reduce the threat of wildfire. The restoration of areas with tornado damage would improve scenic quality overall. However, sequential viewing of combined management activities from the various projects from major travelways within the project area could have a short-term cumulative impact to scenic resources.

The Travel Management Rule closes a number of roads and trails within the Wing Mountain project area. Additionally, the Highway 180 Motorized Trails project, which overlaps with the Wing Mountain project area, is on the Coconino National Forest's Schedule of Proposed Actions for 2012/2013 and would propose to obliterate portions of those non-system trails closed due to

resource concerns under Travel Management, but would also likely include some new trail construction and designation of system motorized trails. This would result in an increase in concentrated motorized use in portions of the forest on designated trails, but these trails would be located and maintained according to FS standards with scenery resources considered in the analysis process. It is unlikely that this project's implementation period would overlap with the Wing Mountain project implementation period; however if overlap were to occur, some treatments that are not visible from CL1 travelways would be visible by users of this new designated system trail system.

A reasonably-foreseeable effect of these projects would be a decrease in undesirable trail locations in sensitive viewsheds/resource areas. As roads are closed and rehabilitated under Travel Management, it can be expected that there would be a minor increase in scenic quality within the localized area of those roads and within the viewsheds where those roads occur. Also, since road closures through Travel Management would overlap with the Wing Mountain project implementation period, many of the extensive non-system user created trails would be closed, leading to less of the forest being seen than is seen under existing conditions. It can reasonably be expected that since less of the forest and therefore treatment area would be seen, this would lead to a potential reduction in short term effects to scenery by some treatment methods.

As the New Planning Rule and the Coconino National Forest Plan revision are completed and implemented, the Visual Management System would be updated to the Scenery Management System, which focuses more on existing and desired scenic integrity and landscape character. All Forest projects undertaken by the Forest Service in the future would consider scenery, and would intend to move forest landscapes to desired conditions, desired landscape characters, and scenic integrity objectives, therefore having a beneficial impact on scenic resources.

The proposed alternative for this analysis would produce a cumulative effect of short-term reductions to SIOs during project implementation along concern route corridors, as proposed treatments would be seen sequentially. Implementation of mitigation measures for the proposed action would return the scenic integrity to designated levels once actions are completed and evidence of disturbance (slash piles, landings, skid trails) are fully restored or treated. Positive cumulative effects are gained once treatments are completed and the forest achieves its desired landscape character of an open forest with large trees, diverse vegetation, and the presence of an herbaceous understory with reduced debris on the forest floor. The project area along concern routes would retain its typical attractiveness and allow for better visibility deeper into the forest from the roadways.

Invasive Plants & Noxious Weeds

Affected Environment

Noxious or invasive weeds can alter ecosystem processes, species composition, species richness, biodiversity, hydrologic functions and soil characteristics (Harrod 2001). Noxious or invasive weeds can also affect structure and function of native ecosystems and can affect factors such as fire interval and intensity, and successional pathways.

Surveys conducted between June 6, 2009 and September 15, 2009 detected several populations of noxious and invasive plant species within the project area (Table 30). Infestations ranged from a few scattered plants to more dense populations.

Table 30: Noxious or invasive weeds detected within the Wing Mountain project area

Common Name	Species*	Species Rank	Objective
Musk thistle	Carduus nutans	8	Eradicate
Diffuse knapweed	Centaurea diffusa	9	Contain/Control
Spotted knapweed	Centaurea maculosa	10	Eradicate
Dalmatian toadflax	Linaria dalmatica	18	Contain/Control
Bull thistle	Cirsium vulgare	20	Contain/Control
Cheatgrass	Bromus tectorum	22	Contain/Control Specific Populations

Each species is rated by the perceived severity and risk to Forest resources. This risk is based on invasiveness and the predicted success of control measures of each species as analyzed in the *Final Environmental Impact Statement for the Integrated Treatment of Noxious or Invasive Weeds, Coconino, Kaibab and Prescott National Forests* (*FEIS*) (USDA Forest Service, 2005). The ratings were taken from the FEIS.

Environmental Consequences

Alternative 1: No Action
Direct and Indirect Effects

No direct effects to noxious or invasive weeds from management actions would occur since none of the management actions identified in the proposed action would take place.

The No Action Alternative would not mediate the risk of severe wildfire which may increase in the project area. Severe wildfires often result in complete removal of tree canopy, complete loss of ground cover and understory plant community and alteration of soil structure and nutrients. These conditions provide potential sites for noxious or invasive weed establishment through creation of bare soil, increased light and absence of competition from desirable plant species. Therefore, increases in fire hazard and severity that would continue to occur with the No Action Alternative would also increase the risk of noxious or invasive weeds establishing in the project area.

Cumulative Effects

Past, present, and reasonably foreseeable actions that would serve as contributing factors to cumulative effects within the project area under the No Action Alternative include:

- Past forest activities such as grazing, vegetation treatments, recreation uses, road maintenance and travel along roadways, including paved roads and highways probably affected the abundance and distribution of noxious or invasive weeds in the project area. However, without information on known distributions of noxious or invasive weed species due to the lack of noxious/invasive weed data gathering and documentation prior

to 1997, the past effects of management actions would be unclear. Sources of introduction for noxious or invasive weeds are often unclear and difficult to verify.

- Historical land management including fire suppression and the alteration of the fire regime have affected all vegetation through an increase in canopy cover, a decrease in density of understory vegetation, decrease in species composition of understory vegetation, and a decrease in ground cover of understory vegetation. Hydrologic function has also been altered due to past land management. As a result, the healthy resilient plant community that would be present in many areas is absent and there are few desirable understory species present to provide competition that would help reduce the potential invasion from noxious or invasive weeds. Past fire suppression has increased the risk and severity of wildfires when they do occur. The effects of the resulting severe fires include high levels of disturbance, loss of the native plant community and possible alteration of habitat.
- Although a beneficial effect of restoring fire to the ecosystem includes restoration of understory species and reduction of fire risk and severity, past effects of prescribed fire on noxious or invasive weeds within the project area are unknown.
- Historical grazing within the project area includes grazing by cattle on the Crater, Maxwell Springs, Peaks and Wild Bill grazing allotments. Currently the portion of the Peaks allotment that falls within the project boundary is not grazed by cattle, and has not been grazed by cattle for over 10 years. The cumulative effects of grazing on noxious or invasive weeds include soil disturbance, trampling, consumption of desirable plants that could provide competition for noxious or invasive weeds, and possible introduction of seeds by cattle through feces and contaminated soil that can be transported on their hooves and coats. Furthermore, the Forest Service has no control on the effects of wild grazers and browsers (such as elk and deer) on invasive and noxious weed populations.
- Approximately 4 miles of pipeline is being buried adjacent to FR 516 to transport water up to Snowbowl ski area. Burial of the pipeline included ground disturbing activity and use of heavy machinery which was contained to the area immediately adjacent to FR 516. Ground disturbing activity may contribute to the spread of weeds by eliminating competition from existing vegetation and creating bare ground that can be easily invaded than in undisturbed sites. The proximity of the construction to the high use paved road FR 516 may increase the risk of noxious or invasive weeds establishing along the pipeline as vehicles can act as vectors for weed seeds.
- Approximately 3 miles of underground gas pipeline are located within the Wing Mountain project boundary. Periodically the ground surface along the ROW needs to be cleared which requires using hand thinning to cut down and remove small trees and shrubs that have established along the ROW. Hand thinning is a less severe form of disturbance compared to mechanical thinning, and does not require the use of heavy machinery. The removal of trees and shrubs from the ROW will be frequent enough that no significant canopy cover will be able to develop. Therefore the removal of trees and shrubs will not significantly increase the amount of available sunlight, bare soil or plant competition. The impacts from hand thinning the ROW will not have a significant impact on native grass and forb species. There is a possibility of introducing weed propagules into the area through foot traffic and equipment.
- The effects of TMR implementation will be the reduction in the numbers of motorized routes and the elimination of cross country travel. Negative effects from motorized vehicles such as crushing of native plants, creating areas of bare soil, transportation of weed propagules and the increased risk of noxious or invasive weeds establishing in the

area will be reduced. These reductions will be a result of the elimination of most cross-country travel and through the reduction of road density. An increased risk of noxious or invasive weed populations establishing in the area may result from activities associated with TMR. Roads that are to be obliterated will require rehabilitation which consists of ground disturbing activities to help return the road corridor to pre-road conditions. Ground disturbing activity may contribute to the spread of weeds by eliminating competition from existing vegetation and creating bare ground that can be easily invaded than in undisturbed sites.

- Cumulative effects from human activities such as dispersed recreation, travel on roadways, hunting, and fire-wood gathering have occurred in the project area. Effects of these activities include disturbance and possible dispersal of noxious or invasive weeds into or within the project area. An example of this is dispersal of Dalmatian toadflax along roadways. The extent and overall past and future effects of these activities are unknown. Many of these activities have occurred in the past and will continue to occur in the future. However, the Forest Service has little or no control over these activities.

The damage that resulted from the 2010 tornado within the project area includes ground disturbance, increased sunlight in some areas, decreased sunlight in some areas, and increased bare spots from fallen trees. Increased bare ground and sunlight will provide conditions for establishment by both native and non-native species. It is possible that noxious or invasive weeds may establish in this area and out-compete native species.

As the No Action Alternative would increase the likelihood of high severity wildfire as discussed under direct/indirect effects, the cumulative effect of this alternative when combined with the bulleted actions would be a likely increase in the establishment of invasive weeds.

Alternative 2: Proposed Action
Direct and Indirect Effects

Ground disturbing activities have the potential to increase the acreage and/or density of the existing noxious or invasive weed infestations within the project area. Disturbance may contribute to the spread of weeds by eliminating competition from existing vegetation and creating bare ground than can be more easily invaded than undisturbed areas. The level of disturbance is important. Severe disturbance removes competitive vegetation, alters nutrient composition, creates bare soil and can severely reduce or eliminate shade, making potential sites for the invasion or spread of noxious or invasive weeds. Ground disturbing activities associated with the Wing Mountain project include rehabilitation of decommissioned roads, creation of temporary roads, resurfacing of roads, use by machinery during mechanical thinning, pile burning and prescribed fire.

Effects associated with mechanical thinning include high levels of disturbance, loss or reduction of existing understory vegetation and creation of bare soil. Additionally, machinery can be sources of noxious or invasive weed introductions.

Effects associated with hand thinning are less severe than mechanical thinning. The effects are similar to prescribed fire and include reduction in tree canopy, release of nutrients, reduction in plant competition, and increase in the amount of available sunlight and creation of bare soil. These factors can benefit understory plants including noxious or invasive weeds. However, these

factors are less severe and would be of less concern than pile burning or machine piling on deck sites.

Tree removal indirectly affects noxious or invasive weeds by reducing tree canopy and stand density. Treatments that reduce the tree canopy and lower the stand density will affect all understory plants, including noxious and invasive weeds by allowing more sunlight, increasing available nutrients and temporarily decreasing interspecies competition as well as intra species competition. The increased availability of resources and decreased competition can also provide favorable conditions for noxious or invasive weeds and could increase the size and density of existing populations, especially in areas where weed infestations already exist.

Slash piling and burning would create localized severely burned areas. Consequences include but are not limited to the reduction or loss of the seed bank of native perennials on these sites (Korb, 2001); death or reduction of soil organisms on the pile sites (Raison, 1979; Ballard, 2000; Korb et al., 2004) and development of hydrophobic soil (Ballard, 2000). Burning slash piles can remove vegetation leaving bare soil and creating sites for the establishment or spread of noxious or invasive weeds. Slash pile sites are more prone to invasion from noxious or invasive weeds than surrounding areas and may contribute to the persistence and spread of noxious or invasive weeds in treated areas. Use of Best Management Practices (BMPs) as outlined in Appendix B of the *Final Environmental Impact Statement for Integrated Treatment of Noxious of Invasive Weeds* (2005) and following the mitigation measures for weed management during Alternative 2 implementation (listed under Design Features in Chapter 2) would help prevent the introduction of new populations and the spread of existing populations within the project area.

Prescribed fire releases nutrients, reduces plant competition, increases the amount of available sunlight and increases bare soil, which may contribute to the expansion of existing noxious weed populations. Prescribed fire may have a direct effect on understory vegetation depending on fire severity, including existing noxious or invasive weed populations within the project area. It is expected that most prescribed fire will be of low severity. Under these conditions, the effects would be similar to those caused by reducing tree canopy. However, fire severity may be higher in limited areas depending on variables such as management goals, weather, fuel conditions and topography. In these cases moderate to high severity may occur. The effects in these areas would be more severe and would be similar to slash pile burning.

The implementation of prescribed fire within the project area may benefit the understory vegetation and may eventually lead to a more resilient, weed resistant plant community within the project area. However, fire will be a source of disturbance that could contribute to the increase of noxious or invasive weed populations. Prescribed fire would reduce the risk of uncontrolled severe wildfire, a more severe disturbance than prescribed fire. Under the conditions of severe landscape scale wildfire, the risk and likelihood of noxious or invasive weed invasions are higher than under the less severe conditions of prescribed fire. Examples of severe, large fires with increased noxious or invasive weed infestations include the Hochderffer and Horseshoe Fires of 1996, the Pumpkin Fire of 2000 and the Schultz Fire of 2010. The prescribed fire treatments that would be a part of the management actions of this project would help reduce the threat of similar severe wildfire within the project area after the completion of the project, reducing the likelihood of the spread of noxious or invasive weeds that might occur from such wildfires.

Cumulative Effects

For a discussion on the contributing factors of cumulative effects to noxious and invasive weed populations within the project area for Alternative 2, refer to the Cumulative Effects section under Alternative 1.

Disturbance and potential introduction of invasives from motor vehicle use in camping corridors along forest roads within the project area such as 222, 222A, 151, and 9232R would add to the likelihood for invasive species populations to get established or spread. In addition, climate change could also cumulatively add to these impacts because it is expected to create conditions where invasives are more likely to establish and spread in natural environments (Hellmann, 2008; Middleton, 2006).

Botany – Forest Sensitive Species

Rusby's milkvetch (*Astragulas rusbyi'*) is the only Region 3 Sensitive Plant species known to occur within the project area

Affected Environment

Rusby's milkvetch is a narrow endemic found on basaltic soils on northwest and west of Flagstaff, Arizona. The range is limited to areas on the Coconino National Forest around the San Francisco Peaks and on the adjacent Kaibab National Forest. It is an upright perennial herb with flowers that are white to cream color and pea-like and bloom from May to September. Habitats for this plant include aspen groves, mixed conifer, ponderosa pine/Arizona fescue, and ponderosa pine/gambel oak sites in dry or temporarily moist basaltic soils. There are numerous occurrences of Rusby's milkvetch within the project area.

Environmental Consequences

Alternative 1: No Action
Direct and Indirect Effects

There would be no direct effects from management actions to existing suitable habitat for Rusby's milkvetch, or to populations or individuals of this species since none of the management actions in the proposed action would occur.

Indirect effects of the No Action Alternative include the persistence and increase of high fire hazard potential. In the case of a stand replacing fire, the risk of death by fire to individuals and groups of Rusby's milkvetch would increase. If a large stand replacing wildfire occurred, the plant community would be impacted and sensitive plant populations would be lost due to large expanses of the forest burning at one time. Severe wildfires often result in deaths of all plants including TES plant species, loss of seed banks (Korb et al., 2004) and volatilization or removal of nutrients (Ballard, 2000; Choromanska and DeLuca, 2002). These are generally long term effects on the plant community that would affect the plant population for several decades. Plants eliminated due to large, hot-burning wildfires may take years re-establish and long-term alteration of habitat would occur.

Under the No Action Alternative, no tree removal would occur and tree density and canopy closure would continue to increase, reducing the availability of resources such as light and water to understory plants including Rusby's milkvetch, resulting in the reduction or elimination of understory plants including Rusby's milkvetch. No reduction of tree density and canopy within the project area would lead to increased competition among all plant species, including Rusby's milkvetch, for resources such as light and water. These indirect effects have minor but notable effects on the potential habitat of Rusby's milkvetch throughout its range.

Cumulative Effects

The cumulative effects analysis is bound by the range of Rusby's milkvetch within the Coconino National Forest. Rusby's milkvetch is a native species and has survived in the area as a component of the native vegetation but was not added to the Region 3 Sensitive Species list until 1999**.** Cumulative effects of Rusby's milkvetch may include past and ongoing management actions by the U.S. Forest Service such as grazing, timber sales and prescribed burning within the project area and throughout its range. Many management actions were initiated before the species were added to the Sensitive Species list so the effects of these actions are unknown.

Fire suppression and past alteration of the fire regime through suppression have affected all vegetation including Rusby's milkvetch through changes in tree density and understory species composition. Elimination of fire in the project area and throughout most of the range of Rusby's milkvetch has allowed tree canopy and stand density to increase in some areas, reducing the abundance or eliminating of most understory species including Rusby's milkvetch. The elimination of fire has also resulted in the increase in litter in some areas which has negatively affected understory plant species by eliminating plants and by contributing to the increase in fire spread, length of residence time of fire and fire severity.

The project area contains all or portions of several large wildfires. These include Fort Valley (1948), Whitehorse (1967), Pipe (2000) and Wing (2007). Severe wildfires often result in deaths of all plants including TES plant species, (Pike et al, 2010) loss of seed banks (Korb et al., 2004) and volatilization or removal of nutrients (Kaye and Hart, 1998; Ballard, 2000; Choromanska and DeLuca, 2002). These effects generally have long term effects on the plant community (Pike et al, 2010). Plants eliminated due to large, hot-burning wildfires may take years re-establish and long-term alteration of habitat occurs.

Other fuels reduction projects have occurred or are currently planned in the habitat of Rusby's milkvetch. These include Fort Valley Ecosystem Restoration Project (2000),_ Hart Prairie Fuels Reduction and Forest Health Project (2010), Jack Smith/Schultz Fuel Reduction and Forest Health Project (2008). These projects could have affected individuals but they were not likely to adversely affect the species as a whole.

Grazing within the project area includes grazing by domestic ungulates and wild grazers. The cumulative effects of grazing include past and present loss of individual plants to grazing animals and alteration of habitat through animal impacts such as trampling and compaction. According to Springer (2004), deer and elk may preferentially select legumes when they find them. However, palatability and use of Rusby's milkvetch by grazers is unknown. Small animals such as rodents may also eat Rusby's milkvetch.

Rusby's milkvetch has been observed along the Schultz Trail, which is adjacent to the project area. Several of the locations detected by survey crews are along the trail. Trail users may

impact individual plants at these locations through trampling and compaction of soil, especially in areas where trail users leave established routes.

In 2000, the Forest withdrew the San Francisco Mountain and Mount Elden areas from mineral exploration. This withdrawal could have indirect long-term beneficial effects on species such as Rusby's milkvetch by preserving habitat that might otherwise be altered through mineral exploration.

The Coconino National Forest is in the process of implementing the Travel Management Rule, which will restrict cross country travel and restrict motor vehicle traffic to approved roadways. The cumulative effects to this and other projects forest wide would be the reduction in the numbers of motorized routes and the elimination of cross country travel. Negative effects from motorized vehicles such as crushing of plants, damage to potential habitat such damage to soils, fragmentation of habitat and introduction of noxious or invasive weeds into the habitats and/or populations would be reduced. These reductions would be from the elimination of most cross-country travel and through the reduction of road density. This would aid in reducing pressures from vehicle travel in sensitive areas where plants and potential habitat occur.

If none of the management actions proposed for this project is undertaken, high fire risk would exist and continue to increase and forest fuels would continue to increase, resulting in increased risk of severe landscape wildfire including crown fire, and Rusby's milkvetch populations risk death in the case of stand replacing and high severity wildfires. This would combine with the ongoing activities described to have a potentially negative cumulative impact on Rusby's milkvetch.

Alternative 2: Proposed Action
Direct and Indirect Effects

Direct effects of the proposed action would include potential mortality of individual plants or population groups through management actions. Factors contributing to these effects would include disturbance from management activities including mechanical activities such as vegetation management, fuel reduction activities and prescribed burning, and disturbances from spring restoration and aspen restoration. Some individuals may be destroyed during prescribed burning, especially in areas where only isolated individuals occur or in areas where plants were not detected during previous surveys. However, prescribed burning may also have beneficial indirect effects.

Prescribed burning may have beneficial direct and indirect effects on all understory vegetation including Rusby's milkvetch depending on fire severity. Burning is a disturbance that can release nutrients, reduce plant competition, and increase the amount of available sunlight light. The effects of burning may initially be negative by reducing the numbers of individuals but would beneficial in the long term by reducing competition, increasing the amount of available sunlight and by increasing available nutrients. In a long-term ponderosa pine ecological restoration study in the Fort Valley Experimental Forest, Rusby's milkvetch was an indicator species of tree thinning and prescribed burning, showing a positive response to treatments (Laughlin et al, 2008). However, in a nearby restoration project on the Coconino National Forest, there appeared to be no relationship to thinning and burning (Moore et al, 2006). In that project, Rusby's milkvetch plants in the area may have remained below ground, responding more to severe drought than fuels reduction treatments.

It is expected that most broadcast and prescribed burning for this project would be of low severity. In some cases, fire severity may be higher in limited areas depending on variables such as management goals, weather, fuel conditions and topography. In these cases moderate to high fire severity may occur. In these areas, there could be limited negative direct effects through mortality of scattered individuals or groups of Rusby's milkvetch if they occur at that particular location. Limited mortality of small groups of plants in these cases would not significantly contribute to the overall decline of populations of this species within the project area or over the ranges of this species. The indirect effects of higher fire severity in these areas would be similar to those for slash pile burning.

One of the associated activities with several treatments includes piling of slash from management activities. Slash piles may have negative direct and indirect effects on all understory vegetation including Rusby's milkvetch. Slash pile construction could be a possible direct negative effect if the pile is placed in or near existing populations of Rusby's milkvetch. These effects can be mitigated by avoiding placing slash piles directly on existing plants and by constructing piles at least 10 to 20 feet away from existing populations. Pile burning would create locally severely burned areas at pile sites, which is a negative indirect effect. Consequences include, but are not limited to, the reduction or loss of the seed bank on these sites (Korb, 2001; Crisp, 2004); mortality or reduction of soil organisms on the pile sites (Raison, 1979; Ballard, 2000; Korb et al., 2004) and development of hydrophobic soil (Kaye and Hart, 1998; Ballard, 2000). Slash pile sites are more prone to invasion from noxious or invasive weeds than surrounding areas and may contribute to the persistence and spread of noxious or invasive weeds in treated areas. Noxious or invasive weeds may have adverse effects on all native plants including Rusby's milkvetch by competing with native species for resources and altering habitat. Mitigation for these effects is to use previously disturbed areas including old pile sites or previously used decking areas where available instead of creating new sites within the forest.

An indirect effect of management actions within the potential habitat of Rusby's milkvetch includes an increased risk of invasion from noxious or invasive weeds. These effects can be mitigated by incorporating the Best Management Practices in Appendix B of the Final Environmental Impact Statement for Integrated Treatment of Noxious or Invasive Weeds, Coconino, Kaibab and Prescott National Forests (2005) (listing in Appendix A of this EA). Incorporation of the Best Management Practices would mitigate the effects of increased disturbance from management activities, and help to control the spread and introduction of weeds within the habitat of Rusby's milkvetch.

Direct and indirect effects of road decommissioning include destruction of individual plants, localized disturbance of suitable habitat and the potential introduction of noxious or invasive weeds. These effects would be mitigated by surveying the sections of road where closure or obliteration would occur as well as nearby areas that may be disturbed and avoiding existing plant populations. Additionally, these activities would have the long-term effect of restoring the available habitat for this species.

The effects of management activities such as fence building and other activities associated with spring restoration and aspen restoration are similar to those for road activities. Mitigations include surveying prior to implementation and avoiding populations during treatment implementation.

Cumulative Effects

The cumulative effects analysis for the Proposed Action includes the boundaries and activities described under the No Action Alternative.

The management actions proposed for this project would have no significant negative effects on the overall distribution and abundance within the project area or within the total range of Rusby's milkvetch, provided the mitigations listed in Chapter 2 are incorporated into the project design and implementation. In areas with localized impacts from pile burning and mechanical treatment there could be cumulative impacts causing a decrease in individuals in small groupings of plants. At the scale of the project area and population, this project in addition to other restoration projects would improve forest conditions and habitat for the species, thus increasing population levels over the next several decades. The project would have beneficial direct and indirect effects on Rusby's milkvetch by reducing fire risk and therefore the threat of severe wildfire within the potential habitat of Rusby's milkvetch within the project area. Additionally, some understory plants including Rusby's milkvetch would benefit from the reduction of tree density and canopy in certain areas of the project by reducing competition for nutrients, light and growing space.

Air Quality

Affected Environment

The Wing Mountain Project area is in the Little Colorado River airshed. Flagstaff is located to the east of the project area with the closest housing and neighborhoods lying immediately adjacent to the project boundary. The Kachina Peaks Wilderness is located northeast of the project area and is treated as a Class I airshed as indicated in the Coconino Land Management Plan (1987, as amended), as are the other two wilderness areas on the District: Kendrick Mountain Wilderness and Sycamore Canyon Wilderness.

The amount and type of smoke emitted from prescribed fire must meet federal and state air quality regulations. The basic framework for controlling air pollutants in the United States is mandated by the 1970 Clean Air Act (CAA), as amended in 1990 and 1999. The Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for specific pollutants emitted in significant quantities throughout the country that may be a danger to public health and welfare.

The Arizona Department of Environmental Quality (ADEQ) models emissions/pollutants from all prescribed burning within the state. Any prescribed burn planned by the Forest Service must be approved by ADEQ on a daily basis. ADEQ will not allow more acres burned per day, per air shed, than is acceptable with current air quality forecasts. When the US Forest Service prescribe burns, the burn boss is responsible for monitoring smoke plume trajectories to assure impacts are within predicted values. The burn boss will make changes as needed when unpredicted weather may result in more significant impacts.

There are two highly used FS roads within the project boundary, FR151 and FR222. Recreationists use these roads in conjunction with Highway 180 to access many areas on which to recreate within the project area. Most visitors that take advantage of the recreation opportunities

that exist within the project area do so mostly during the spring, summer, and fall months. Some of these activities include hiking, recreational vehicle camping as well as tent camping, hunting, wildlife viewing, scenic driving, and ATV/UTV use. People also cross country ski, snowmobile, and sled in the selected areas during the winter months. Wing Mountain snow play area which is only operational during the winter when there is adequate snow on the ground for sledding is located at the Wing Mountain pit within the project area.

The prevailing winds for the Wing Mountain Project area are out of the southwest. However, as fronts pass winds can arrive from any direction for a period ranging from a few hours to three days. Atmospheric inversions can prevent smoke from dispersing. Within the project area, inversions mostly occur between October and December during the year. Stagnant atmospheric conditions result from low mixing heights and light transport winds. These conditions, when they occur, may last from twelve hours to several days (Arizona Department of Environmental Quality, Fort Collins Weather Database).

Environmental Consequences

Alternative 1: No Action
Direct and Indirect Effects

Alternative 1 would produce no direct effects since no prescribed burning would occur. However, analyzing the emissions from a wildfire occurring within the project area that has not been treated using the Simple Approach Smoke Estimation Model v. 4.0 (SASEM) and FOFEM v. 5.9, the amount of fuel consumed and the smoke generated by a wildfire would be greater than that under Alternative 2.

Under extreme weather conditions, a wildfire would mostly likely burn many acres of land (more than would be planned to prescribe burn in a day) due to the difficulty of suppressing a wildfire in an untreated area by direct attack. Indirect attack most likely would have to be used. The resulting smoke from wildfire would spread wider and farther than under prescribed burning. Nighttime smoke would reach farther and impact the nearby communities more severely. Smoke would exceed air quality standards in both volume and duration.

Cumulative Effects

In analyzing the cumulative effects for air quality for the project, the area contained within the Little Colorado River airshed and the airshed of the Kachina Peaks Wilderness were considered. Forest health and fuel reduction projects that have occurred in close proximity to the Wing Mountain project area have most likely helped with reducing the potential effects of wildfire in the Wing Mountain project area. These fuel reduction projects include Hart Prairie Fuels Reduction and Forest Health Restoration, Fort Valley, A-1West and East, Lake Mary, Skunk, Eastside, and Woody Ridge Fuels Reduction projects. However, by not treating the Wing Mountain project area itself, the project area and surrounding untreated forested areas would most likely experience damaging fire effects and produce great quantity of smoke emissions if a wildfire entered into the untreated project area under extreme weather conditions.

The Coconino National Forest averages about four hundred wildfires a year. Roughly half of these are human-caused with the balance caused by lightning. On average there are eighty-five days a year in which multiple wildfires start. The vast majority of these fires are controlled at one-tenth of an acre. Large destructive fires increase the average annual wildfire acres up to four

thousand acres a year. Smoke from a wildfire occurring under modeled conditions would exceed air quality standards. As more area is left untreated on the Forest, smoke from a wildfire occurring under the No Action Alternative could accumulate with emissions from other wildfires and further exceed air quality standards.

Alternative 2: Proposed Action
Direct, Indirect and Cumulative Effects

Alternative 2 seeks to reduce the fire hazard while retaining as many nutrients on site as possible. It proposes prescribed burning approximately 10,489 acres of piled thinning slash and approximately 11,066 acres of surface fuels on the forest floor using broadcast burning techniques. A direct effect of Alternative 2 is that smoke from prescribed burning would have short-term impacts on local air quality. These effects come from three sources: 1) pile burning of slash generated from thinning trees, 2) initial entry broadcast burning of the forest floor, and 3) maintenance broadcast burning of the forest floor. Emissions generated by these actions have been modeled using SASEM v. 4.0 for the project and are found in Table 31.

Table 31: Comparison of Prescribed Burning and Wildfire Emissions

Comparison of Burn Emissions	Existing Condition Wildfire	Post Treatment Wildfire	Pile Burn	Initial Prescribed Burn	Maintenance Prescribed Burn
Ground Fuel Consumed (Tons per Acre)	8	2	Not Applicable	7	2
Total Suspended Particles (TSP) Total Emissions Tons	30	0.3	6	13	3
Air Quality Standards	Exceeded	Unlikely to be Exceeded	Unlikely to be Exceeded	Rarely Exceeded	No Exceedance

Pile-burning is relatively efficient combustion producing fewer emissions than both wildfires (pre-treatment) and initial-entry prescribed-burning. A direct effect of Alternative 2 would be that some smoke from pile burning could still subside into the neighborhoods in and around the project area after most of the piles have burned down to 10 % or less of their original size. Pile burning near subdivisions could cause short-term smoke impacts, usually lasting at the most a day, to a subdivision.

The initial prescribed burning of the forest floor produces more emissions than pile burning, but far less than most wildfires burning in the same (pre-treatment) fuel bed. The initial broadcast burning of each block in the project area would generate smoke for as long as seventy-two hours after ignition. The emissions from implementing would generally meet National and State Ambient Air Quality Standards because burning would only occur under weather conditions that

are favorable for burning and on a certain number of acres of land that would reduce smoke impacts to surrounding areas.

Once initial entry burning has occurred, successive maintenance burns would be implemented every three to seven years to mimic the historic fire regime. They would generate less smoke volume, be shorter in duration, and have virtually no smoke after sunset compared to that created by an initial prescribed burn and far less than that created by a wildfire.

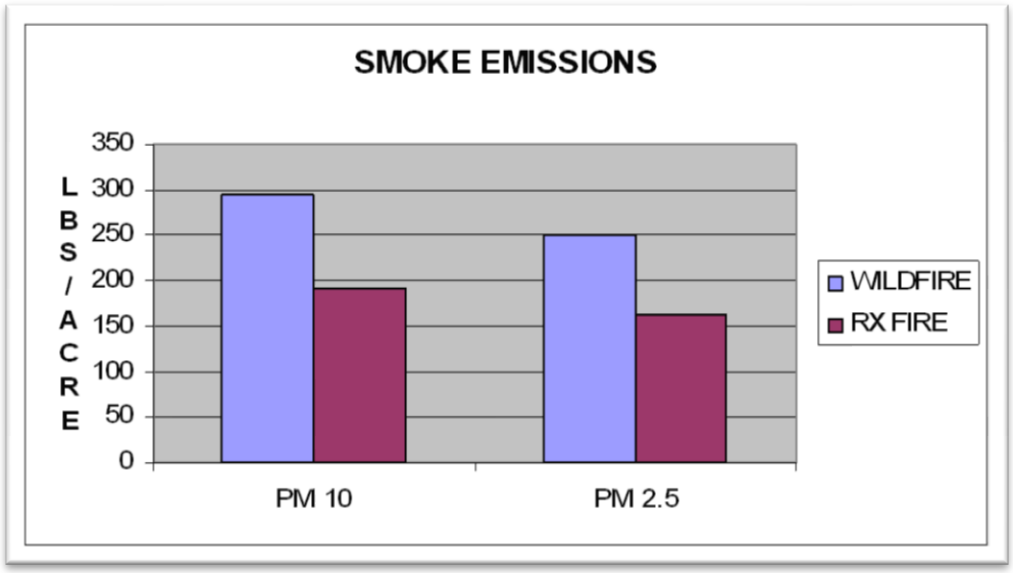
The high level of recreation activity that occurs in the summer months in and around the Wing Mountain project area would not likely to be impacted by smoke because very little to no prescribed burning would be conducted during the summer. Recreationists visiting the project area and surrounding areas in the fall and spring could be impacted by smoke from prescribed burning. The smoke impact could last for as long as seventy-two hours during initial entry broadcast burning, but usually only six hours during maintenance burning.

Smoke plume trajectories indicate that the communities within and adjacent to the project area and Highway 180 could be impacted by smoke when burning. Short-term air quality degradation and reduced visibility could be experienced in the smoke plume trajectories. After sunset, cooling atmospheric conditions would carry smoke down drainages. These down canyon flows would reach the communities around the project area in the early morning hours.

The early morning flows could carry smoke down slope and reduce visibility in surrounding low lying areas when blocks adjacent to these potentially smoke impacted areas are being burned. These portions would be posted with appropriate signs warning residents living adjacent to the project area, forest visitors, and motorists of reduced visibility. Ignition of each day's block would be completed in the afternoon, thus limiting the smoke generated after atmospheric cooling begins. Smoke impacts would be much worse should a wildfire occur under modeled weather conditions without the implementation of the proposed action.

The reduction in the fuel load and the increased openness of the canopy would allow future broadcast burning under a wider range of weather conditions than the existing conditions. The ability of burn managers to limit undesirable smoke impacts would be increased by having a wider range of weather parameters within which to burn. The areas thinned mechanically would allow the widest range of weather conditions under which prescribed burning could take place and lowest risk of smoke impacts because they would result in the most open canopy conditions which allow for better ventilation and smoke dispersal during burning. The areas thinned by hand would allow the next widest range. Areas receiving burn only treatments would or would not have an open canopy dependent on their existing condition. Burning in stands that are not thinned and have high canopy closures would most likely produce the heaviest smoke impacts. Potential heavy smoke impacts would be avoided by burning on days with favorable ventilation as regulated by the Arizona Department of Environmental Quality (ADEQ).

Figure 15: Smoke Emissions for particulate matter[7] 10 and 2.5 for prescribed fire and wildfire



Heritage

Affected Environment

The project area is considered to have low to moderate archaeological site density. Surveys identified 43 historical properties which reflect the long history of human occupation and use of the area from early Archaic hunter gatherer activities through the Sinagua period and culminating with mid-20th century sites from Euro and Native American use and settlement of the area. Of the 43 archaeological sites 27 are prehistoric, 14 are historic and 2 have aspects of both prehistoric and historic periods. Furthermore, twenty –one sites are currently eligible for the National Register of Historic Places and twenty-two sites remain unevaluated as they are in need of further testing or analysis. One Traditional Cultural Property (TCP) was identified with the project area. This TCP is part of the San Francisco Peaks traditional use area.

The archaeological resources in the project area have moderate to high levels of dead fuels growing in and around them. The desired condition for heritage resources within the Wing Mountain project is to reduce fuel loading in and around all eligible historic properties without the sites experiencing any adverse effects. This strategy will assist in site preservation, limit disturbance from potential emergency fire suppression ground disturbing activities to sites, and

[7] Particulate matter consists of inhalable coarse particles (>2.5 and <10 micrometers) and fine particles (=<2.5 micrometers in diameter) (http://www.epa.gov/pm/)

ensure the continuation of future research and interpretation for these irreplaceable historic resources

Environmental Consequences

Alternative 1: No Action
Direct, Indirect and Cumulative Effects

Existing fuels in and around archaeological sites would remain as they are and continue to increase. No action may result in high intensity wildfires that these sites have not been subjected to in the past; potentially resulting in possible subsurface artifact damage and potentially ground disturbing fire suppression tactics.

Fire suppression actions, particularly bulldozer operations, may damage or completely destroy surface and subsurface heritage resources resulting in the loss of those resources and their associated data. Intense wildfires may also contribute to increased erosion of sites leading to the loss of their research potential and eligibility for the National Register of Historic Places. Since the project area lies within the Wildland Urban Interface (WUI), aggressive suppression actions are likely to occur, and the possibility of damage to resources would be possible through ground disturbing fire suppression actions.

Over time, fuels would continue to increase in and around archaeological sites which would keep them out of the visibility of public users, a beneficial effect. However, as stated in direct and indirect effects, increased fuels would have a long term negative cumulative effect if a wildfire burned over these sites because the sites would burn hotter and longer than expected in a managed, controlled burn setting.

Alternative 2: Proposed Action
Direct and Indirect Effects

Unnatural fuel loading would be reduced in and around National Register eligible archaeological sites. Wildfires and associated suppression actions along with post fire erosion impacts would be reduced through thinning and low to moderate intensity prescribed burning.
Allowing low intensity prescribed fires to burn through prehistorically/historically burned archaeological sites along with thinning would reduce current fuel loads in and around those sites. This treatment would prevent extensive heat damage during any future wildfire event thus lowering fire damage to heritage resources. Increased visibility/vandalism resulting from loss of ground cover can be mitigated through archaeological monitoring, public education, and law enforcement patrols. Additionally, ground cover would recover more quickly after a low intensity prescribed fire than after a high intensity wildfire.

If the Proposed Action is implemented, emergency fire suppression activities would be lessened and the potential for ground disturbing activities like bulldozer fire-line construction would be reduced, therefore, protecting National Register eligible heritage resources per the 1966 National Historic Preservation Act as amended, the 2001 Region 3 WUI Programmatic Agreement, and the 1987 Coconino National Forest Plan. Erosion from high intensity fire through soil sterilization and complete loss of ground cover would be reduced through selective thinning and low intensity burning that would not sterilize soil and leave large portions of the existing ground cover. Fire intolerant sites would be excluded from burning and ground disturbing actions unlike in an emergency wildfire situation. Also, closing roads in the project area would limit access to archaeological sites and, therefore, would be considered a beneficial effect.

Cumulative Effects

Fire damage, suppression actions, increased visibility/vandalism, and erosion are the primary issues involving archaeological properties in the 11,143 acre project area. Cumulative effects are anticipated to be minimal and can be reduced and/or mitigated through appropriate actions for this and other WUI Fuel Reduction Projects on the forest.

There would be no cumulative effects resulting from fire damage as current forest fuels projects allow the burning of previously burned or fire tolerant sites and exclude all fire intolerant sites from those actions. There would be no change in the current status or treatment of archaeological sites resulting from the project.

There would be no cumulative effect resulting from suppression any more than without the project. Currently in the WUI, the Forest uses aggressive suppression tactics and life and property concerns take precedence over all other values. If the Proposed Action is implemented, the proposed activities would reduce the need for emergency suppression actions, and in the unlikely event that suppression actions are necessary, they would be minimal after treatment. There is a possibility of increased cumulative effects with regards to the visibility and/or vandalism issue for archaeological properties if the project is implemented. Much of the project area is used by local residents for recreation and the reduction of ground cover through thinning and burning has the potential to increase site visibility and vandalism issues. This situation can be mitigated through the measures previously identified. Cumulative effects of erosion issues resulting from prescribed burning are currently unknown. However, if low to moderate intensity prescribed fires are implemented and some vegetation remains, erosion would be minimized. To reduce any potential threat, post fire archaeological monitoring over the next 10 years, especially on slopes, drainages, and other high probability areas, would be implemented.

Chapter 4 – Preparers, Consultation and Coordination

The following Forest Service Interdisciplinary Team Members prepared this Environmental Assessment:

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The Forest Service consulted and notified the following individuals, Federal, state and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

FEDERAL, STATE, AND LOCAL AGENCIES

United States Fish and Wildlife Service
Arizona Department of Game and Fish
Flagstaff Chamber of Commerce
ADOT
Flagstaff City Council
Coconino County Board of Supervisors
Friends of Rio de Flag

TRIBES

Fort McDowell Yavapai Nation
Havasupai Tribe
Hopi Tribe
Hualapai Tribe
Navajo Nation
Pueblo of Acoma
Pueblo of Zuni
San Carlos Apache Tribe
San Juan Southern Paiute Tribe
Tonto Apache Tribe
White Mountain Apache Tribe.
Yavapai-Apache Nation
Yavapai-Prescott Tribe

ORGANIZATIONS

Arizona Trail Association

Flagstaff Biking Organization
Grand Canyon Trust
Friend of Northern Arizona Forests
Wildearth Guardians
Center for Biological Diversity
The Nature Conservancy
Greater Flagstaff Forests Partnership
Sierra Club – Grand Canyon Chapter
NRCS
Rocky Mountain Research Station
Coconino Trail Riders
Arizona Snowbowl

Chapter 5 - References

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Appendix A – BMPs

Best Management Practices from the EIS for Integrated Treatment of Noxious or Invasive Weeds, 2005

Objective	Best Known Practice
1. Incorporate weed prevention and control into project layout, design, and alternative decisions	1.1 – Environmental analysis for projects and maintenance programs will need to assess weed risks, analyze potential treatment of high-risk sites for weed establishment and spread, and identify prevention practices. Determine prevention and maintenance needs, including the use of herbicides if needed, at the onset of project planning
2. Avoid or remove sources of weed seed and propagules to prevent new weed infestations and the spread of existing weeds.	2.1 – Before ground-disturbing activities begin, **inventory** and **prioritize treatment** of invasive weeds in project operating areas and along access routes, or within reasonably expected potential invasion vicinity. Do a risk assessment accordingly; control weeds as necessary. 2.2 – After completing "Practice 2.1" above, reduce risk of spreading and creating weed infestations. Plan operating areas and access routes to avoid heavy infestation areas, plan closure of access routes at finish of project, and/or begin project operations in uninfested areas before operating in weed-infested areas. Locate and use weed-free project staging areas. Avoid or minimize all types of travel through weed-infested areas, or restrict to those periods when spread of seed or propagules are least likely.
	Equipment Wash Station – Centralized wash station areas will be developed in several locations throughout the CNF. They must have a filter system, for example at least 6 inches of large cinder or gravel spread over an area 10' x 30' . Filter cloth may be used for temporary stations. The area will be a perched drainage to allow excess moisture to drain after being filtered and must be at least 200 yards from a natural drainage to avoid contamination. All wash station locations must be monitored annually and all weed materials removed as soon as possible.
	2.3 – Remove mud, dirt, and plant parts from project equipment before moving it into a project area. Determine the need for, and when appropriate, identify sites where equipment can be cleaned. Clean all equipment before entering National Forest System lands; a forest officer, in coordination with the unit invasive species coordinator, needs to approve use of on-forest cleaning sites in advance. This practice does not apply to service vehicles traveling frequently in and out of the project area that will remain on a clean roadway. Seeds and plant parts need to be collected when practical and incinerated.
	2.4 – If operating in areas infested with weeds, clean all equipment before leaving the project site. To minimize time spent cleaning equipment, time all work in infested areas last and concurrently, designate a "contaminated" parking lot where project vehicles working in the infested area may be parked for the duration of the project. This area should be monitored in follow-up mitigation and should be near a "clean" vehicle/equipment lot.

Objective	Best Known Practice
	Identify sites where equipment and vehicles can be cleaned before leaving the site at the end of the project. Seeds and plant parts need to be collected when practical and incinerated.
	2.5 – Workers need to inspect, remove, and properly dispose of weed seed and plant parts found on their clothing and equipment after being trained to recognize the priority species in the area. Proper disposal means bagging the seeds and plant parts and incinerating them. 2.6 – Coordinate project activities between resources and between agencies (such as city, county, ADOT, ASLD) with any nearby weed treatments, including herbicide applications, to maximize cost effectiveness of weed treatments.
3. Prevent the introduction and spread of weeds caused by moving infested sand, gravel, borrow, and fill material in Forest Service, contractor and cooperator operations.	3.1 – Inspect material sources on site annually, and ensure that they are weed-free before use and transport. Treat weed-infested sources for eradication, and strip, stockpile, and treat contaminated material before using pit materials. 3.2 – Inspect and document the areas where materials are used (including those from treated weed-infested sources) annually for at least 3 years after project completion to ensure that any weeds transported to the site are promptly detected and controlled. 3.3 – Maintain stockpiled, uninfested material in a weed-free condition. 3.4 – Work with the responsible transportation agencies to adopt these practices for maintenance of roads that cross National Forest System lands.
4. Avoid creating soil conditions that promote weed germination and establishment.	4.1 – Minimize soil disturbance to the extent practical, consistent with project objectives. 4.2 – In those vegetation types that have relatively closed canopies as a natural condition, retain shade to the maximum extent possible to suppress weeds and prevent their establishment and growth in and around project activity.
5. Where project disturbance creates bare ground, establish vegetation to minimize favorable conditions for weeds.	5.4 – Monitor and document all limited term ground-disturbing operations near weed infested areas for at least five growing seasons, or the documented seed viability for the species of concern following completion of the project. For ongoing projects, continue to monitor until reasonable certainty is obtained that no weeds have occurred. Provide for follow-up treatments based on inspection results 5.5 – Evaluate options, including closure, to minimize future infestations on sites where desired vegetation needs to be established
Prescribed Fire	
FM-4. Manage fire as an aid in control of weeds to prevent new weed infestations and the spread of existing weeds.	4.1 – Pre-inventory project area and evaluate weeds present with regard to the effects on the weed spread relative to the fire prescription. Remove weeds (live plants and seed sources) before project initiation. 4.2 – Plan to avoid or remove existing sources of weed seed and propagules. Avoid ignition and burning in areas at high risk for weed establishment or spread due to burn aftereffects. Treat weeds that establish or spread because of unplanned burning of weed infestations. 4.3 – Burn noninfested areas first before entering weed infested sections of the burn. Clean all equipment when project is completed. Or treat and burn all infested areas first to remove seed source then clean equipment and proceed to uninfested areas.

Objective	Best Known Practice
FM-5. Avoid creating soil conditions that promote weed germination and establishment.	5.1 – Time burns to promote native species and to hinder weed species germination. 5.2 – Consult weed species specific information and consider effects of current local conditions on species growth.
Timber Harvest Operations and Stewardship Contracting	
VM-1. Avoid or remove sources of weed seed and propagules to prevent new weed infestations and the spread of existing weeds.	1.1 – Treat weeds on contracted projects, emphasizing treatment of weed infestations on existing landings, skid trails, and helibases before activities commence. 1.2 – Train contract administrators to identify weeds and select lower risk sites for landings and skid trails. 1.3 – Encourage operators to maintain weed-free mill yards, equipment parking, and staging areas. 1.4 – Use standard timber sale contract clauses such as WO-C/CT 6.36 to ensure appropriate equipment cleaning.
VM-2. Retain native vegetation in and around project activity and minimize soil disturbance.	2.1 – Minimize soil disturbance to no more than needed to meet project objectives. Logging practices to reduce soil disturbance include, but are not limited to: • Over-snow logging • Skyline or helicopter logging • Reuse landings, skid trails and helibases when they are weed free 2.2 – Minimize period from end of logging to site preparation, revegetation, and contract closure.

Appendix B – Management Areas

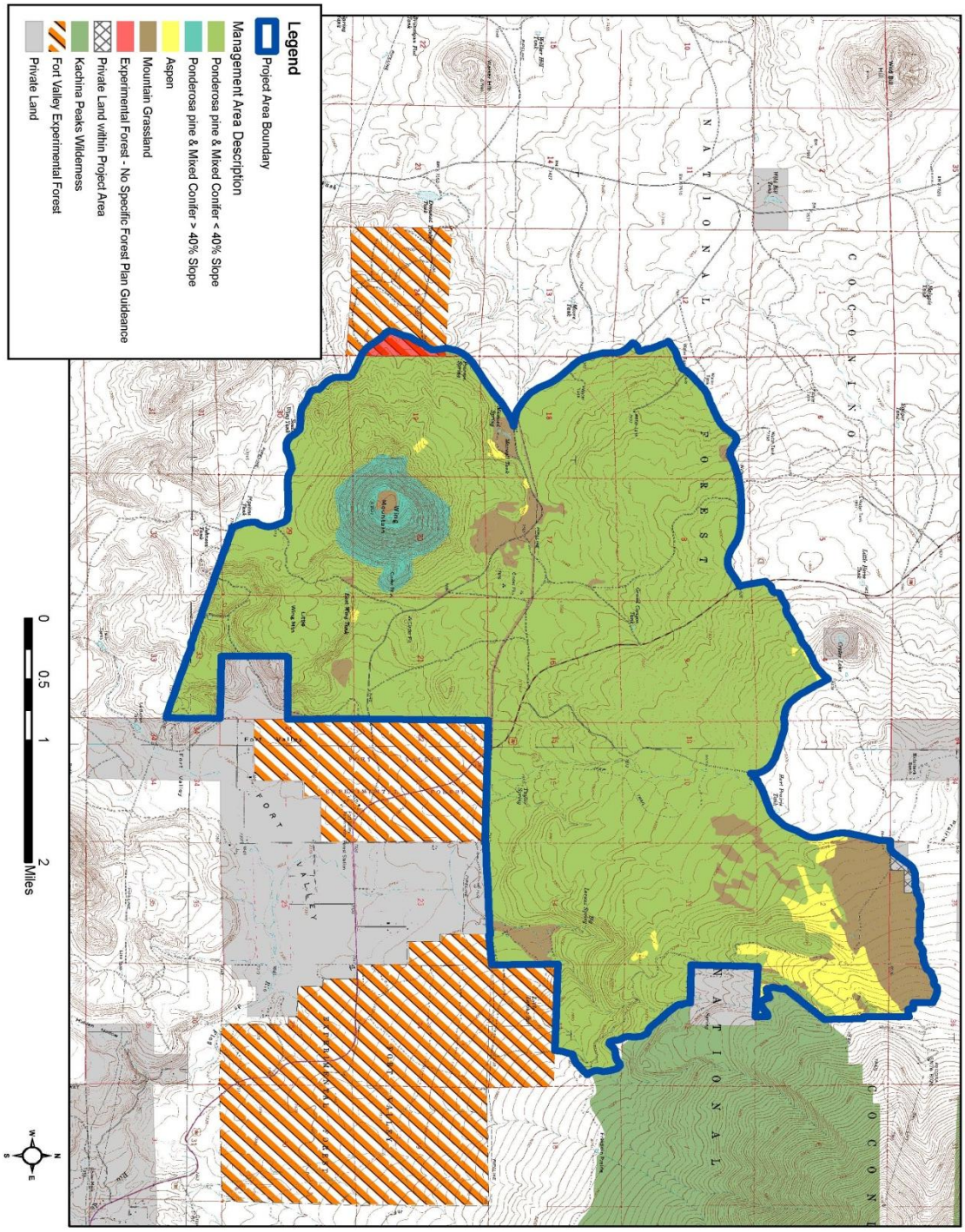
The map below depicts management area boundaries that were revised from the original management areas created in the mid-1980s to address the differences between the original map and what is on the ground today. According to page 47 of the Coconino Forest Plan: "To apply management practices or activities, manager will locate the practices or activities on management and analysis area maps and field check the location to determine the applicable standards and guidelines to be met. Then the suitability of applying the practices or activities is determined for that specific location...The transition between vegetative zones is highly variable. The variability results in isolated parcels of individual analysis areas that do not match the Forest map of management areas for which the standards and guidelines were written. In these instances, proposed practices or activities are governed by standards and guidelines from the management area description that most accurately depict the real situation on-the-ground" (USDA 1987, as amended).

The original Forest Plan management areas (1987) are listed in the table below:

MA	DESCRIPTION	ACRES
3	Ponderosa pine and mixed conifer on less than 40% slope	7,678
5	Aspen	697
6	Unproductive Timber Land	88
9	Mountain meadows and wet grasslands	326
10	Transition grassland and pinyon-juniper above the rim	131
20	Highway 180 Corridor	832
38	West	1,328
EXP	Experimental Forest	46
PVT	Private Land	18
Grand Total		11,144

The revised management areas are listed in the table below:

MA	DESCRIPTION	ACRES
3	Ponderosa pine and mixed conifer on less than 40% slope	9,655
4	Ponderosa pine and mixed conifer on greater than 40% slope	386
5	Aspen	374
9	Mountain meadows and wet grasslands	665
EXP	Experimental Forest	46
PVT	Private Land	18
Grand Total		11,144



Appendix C – Forest Plan Amendment

Introduction

The Coconino National Forest Plan (hereafter referred as "Forest Plan") directs projects to manage for uneven-aged stand conditions within goshawk habitat. Forested groups consist of an interspersion of six vegetation structural stages (VSS 1 to VSS 6). For the purposes of this amendment, the following definitions apply:

- **Stand**: A stand is defined as a contiguous area of trees sufficiently uniform in forest type, composition, structure, and age class distribution, growing on a site of sufficiently uniform conditions to be a distinguishable unit. Four classification characteristics are generally used to distinguish forest stands: bio-physical site (soils, aspect, elevation, plant community association, climate, etc…), species composition, structure (density, and age (1-aged, 2-aged, uneven-aged)), and management emphasis (administrative requirements and local management emphasis that will shape structure over time). Based upon agency guidelines, the minimum stand mapping size is 10 acres.

- **Interspace:** The space between groups and clumps of trees (VSS 1-6) that are intended to be dominated by grass/forb/shrub vegetation and may include scattered individual trees.

Amendment Description

In the "Vegetation Management - Landscapes Outside Goshawk Post-fledgling Family Areas" and "Vegetation Management -Within Post-fledgling Family Areas" section of the forest plan, a non-significant plan amendment would: (1) remove and/or replace references to using vertical crown projection to measure canopy cover with language specific to this analysis, (2) add the desired percentage of interspace within uneven-aged stands to facilitate restoration and define interspace, (3) add the interspace distance between tree groups, (4) add language clarifying where canopy cover is and is not measured, (5) provide minimum stocking guidelines to inform canopy cover at the group level as displayed in tables 1-2 and 1-3, and, (6) add language clarifying reserve trees are specific to created regeneration openings in Landscapes Outside Goshawk Post-fledgling Family Areas. New or edited text is underlined in the "Proposed New Guideline Language" column in Table 1-1.

Relevant Forest Plan Direction

Vegetation Management – Landscapes Outside Goshawk Post-fledging Family Area's

General:
Snags are 18" or larger DBH and 30 feet or larger in height, downed logs are 12 inches in diameter and at least 8 feet long, woody debris is 3 inches or larger on the forest floor, canopy cover is measured with vertical crown projection on average across the landscape (Coconino National Forest Plan, p. 65-9).

Canopy Cover: Canopy cover guidelines apply only to mid-aged to old forest structural stages (VSS 4, VSS 5, and VSS 6) and not to grass/forb/shrub to young forest structural stages (VSS 1, VSS 2, and VSS 3) (Coconino National Forest Plan, p. 65-9).

Ponderosa Pine: Canopy Cover for mid-aged forest (VSS 4) should average 40+%, mature forest (VSS 5) should average 40+%, and old forest (VSS 6) should average 40+%. Opening size is up to 4 acres with a maximum width of up to 200 feet. One group of reserve trees, 3-5 trees per group, will be left if the opening is greater than an acre in size. Leave at least 2 snags per acre, 3 downed logs per acre, and 5-7 tons of woody debris per acre (Coconino National Forest Plan, p. 65-10).

Vegetation Management - Within Post-fledging Family Areas

General: Provide for a healthy sustainable forest environment for the post-fledging family needs of goshawks. The principle difference between within the post-fledging family area and outside the post-fledging family area is the higher canopy cover within the post-fledging family area and smaller opening size within the post-fledging family area. Vegetative Structural Stage distribution and structural conditions are the same within and outside the post-fledging family area (Coconino National Forest Plan, p. 65-10).

Ponderosa Pine: Canopy Cover for mid-aged forest (VSS 4) should average 1/3 60+% and 2/3 50+%. Mature (VSS 5) and old forest (VSS 6) should average 50+% (Coconino National Forest Plan, p. 65-10).

Woodland: Maintain existing canopy cover levels (Coconino National Forest Plan, p. 65-10).

Background

Canopy cover is defined as "the percentage of a fixed area covered by the crowns of plants delimited by a vertical projection of the outermost perimeter of the spread of foliage" (Reynolds et al. 1992). Obtaining consistent results has been difficult; even the definition of the term is dependent on the method of measurement. To resolve this issue, researchers have investigated the possibility of relating canopy cover to basal area (a metric easily derived from most forest inventories) and relate it to the stand averages of observed average percent crown cover. Studies specific to ponderosa pine forests that have successfully predicted canopy cover at the stand level

by inferring the relationship between estimated stand basal area and canopy cover include Vaughn and Ritchie 2005, Mitchell and Popovich 1997 and Sheppard et al. 2001.

The only reference the forest plan has in terms of measuring canopy is in directing projects to measure "vertical crown projection on average across the landscape" (see Coconino National Forest Plan, p. 65-9). Whereas the forest plan clearly provides direction for meeting minimum canopy cover percentages in VSS 4 to 6, the plans lack explicit language for measuring canopy cover. Although the forest plan provides direction and desired conditions for the vegetation structural stages, the forest plan does not describe the relationship between non-forested areas (interspace) and natural openings across the landscape. The forest plan is also silent on what percent of the landscape should be managed for non-forested areas (interspaces) that occur between individual trees, tree clumps, and tree groups. These non-forested areas (interspaces) are not equivalent to VSS 1. Whereas VSS 1 may provide openings in the short term, this structural stage is expected to regenerate tree cover in the long-term.

Need for Plan Amendment

There is a need to define and describe interspace, clarify the relationship between interspace to the vegetation structural stage (VSS) classes, and describe how canopy cover would be measured in landscapes outside and within goshawk Post-fledgling Family Area's. This amendment does not include those acres proposed for grassland or meadow treatment which facilitate movement of some ponderosa pine acres towards an open reference condition, those acres of habitat where no treatments are proposed (goshawk nest stands), or acres where prescribed burn-only treatment is proposed. Northern goshawk standards and guidelines outlined in the CNF LMP apply to forested and woodland areas outside of MSO protected and restricted areas. This makes up approximately 8,038 acres of ponderosa pine stands within the Wing Mountain project area. There are no woodland areas within the project boundary.

Table 1-1. Management of canopy cover in goshawk habitat

Amendment No.	Current Coconino NF Forest Plan Direction	Proposed New Guideline Language
Vegetation Management		
Landscapes Outside Goshawk Post-fledgling Family Areas		
1-1	**General**: Snags are 18" or larger DBH and 30 feet or larger in height, downed logs are 12 inches in diameter and at least 8 feet long, woody debris is 3 inches or larger on the forest floor, canopy cover is measured with vertical crown projection on average across the landscape (Coconino Forest Plan, p. 65-9).	**General:** Snags are 18" or larger DBH and 30 feet or larger in height, downed logs are 12 inches in diameter and at least 8 feet long, woody debris is 3 inches or larger on the forest floor, canopy cover is measured with vertical crown projection on average across the landscape <u>except as follows</u>: <u>In the 8,038 acres of habitat evaluated for the Wing Mountain project, estimates of percent canopy cover at the stand level should be calculated in VSS 4-6 using the algorithmic relationship (Shepperd et al.</u>

Amendment No.	Current Coconino NF Forest Plan Direction	Proposed New Guideline Language
		2001) that is relevant to northern Arizona ponderosa pine forests: Canopy Cover = -57.44 + 25.5047*LN(BA). Canopy cover should be averaged to a per-acre basis and averaged across the landscape. Canopy cover at the group level should be informed by the minimum stocking guidelines displayed in table 1-2.
1-2	No corresponding forest plan direction	In the 8,038 acres of habitat evaluated for the Wing Mountain project, develop and maintain 10 -30% of the uneven-aged stand as interspaces between tree groups. Interspaces are the spaces between groups and clumps of trees (VSS 1-6) that are intended to be dominated by grass/forb/shrub vegetation and may include scattered individual trees.
1-3	No corresponding forest plan direction	In the 8,038 acres of habitat evaluated for the Wing Mountain project, tree group spatial distribution may be highly variable based on local site and current conditions; the interspaces between groups may range from 20-200 feet, but generally between 25-100 feet apart from drip line to adjacent drip line. This spacing of groups is not affected by single trees in the interspace.
1-4	**Canopy Cover**: Canopy cover guidelines apply only to mid-aged to old forest structural stages (VSS 4, VSS 5, and VSS 6) and not to grass/forb/shrub to young forest structural stages (VSS 1, VSS 2, and VSS 3) (Coconino Forest Plan, p. 65-9).	Canopy Cover: Canopy cover guidelines apply only to mid-aged to old forest structural stages (VSS 4, VSS 5, and VSS 6) and not to grass/forb/shrub to young forest structural stages (VSS 1, VSS 2, and VSS 3) except as follows**:** In the 8,038 acres of habitat evaluated for the Wing Mountain project, canopy cover is measured within mid-aged to old forest structural stages (VSS 4, VSS 5, and VSS 6) and not within grass/forbs/shrub or young forest structural stage groups (VSS 1, VSS 2, and VSS 3) or in interspaces, natural meadows, grasslands, or other areas not managed for forest cover. Estimates of percent canopy cover at the stand level should be calculated in VSS 4-6 using the algorithmic relationship (Shepperd

Amendment No.	Current Coconino NF Forest Plan Direction	Proposed New Guideline Language
		et al. 2001) that is relevant to northern Arizona ponderosa pine forests: Canopy Cover = -57.44 + 25.5047*LN(BA). Canopy cover should be averaged to a per-acre basis and averaged across the landscape. Canopy cover at the group level should be informed by the minimum stocking guidelines displayed in table 1-2.
1-5	**Ponderosa Pine:** Canopy Cover for mid-aged forest (VSS 4) should average 40+%, mature forest (VSS 5) should average 40+%, and old forest (VSS 6) should average 40+%. Opening size is up to 4 acres with a maximum width of up to 200 feet. One group of reserve trees, 3-5 trees per group, will be left if the opening is greater than an acre in size. Leave at least 2 snags per acre, 3 downed logs per acre, and 5-7 tons of woody debris per acre (Coconino Forest Plan, p. 65-10).	**Ponderosa Pine**: Canopy cover for mid-aged forest (VSS 4) should average 40+%, mature forest (VSS 5) should average 40+%, and old forest (VSS 6) should average 40+%. Opening size is up to 4 acres with a maximum width of up to 200 feet. One group of reserve trees, 3-5 trees per group, will be left if the opening is greater than an acre in size. Leave at least 2 snags per acre, 3 downed logs per acre, and 5-7 tons of woody debris per acre except as follows: In the 8,038 acres of habitat evaluated for the Wing Mountain project, Ponderosa Pine: Canopy cover for mid-aged forest (VSS 4) should average 40+%, mature forest (VSS 5) should average 40+%, and old forest (VSS 6) should average 40+% within tree groups. Opening size is up to 4 acres with a maximum width of up to 200 feet. One group of reserve trees, 3-5 trees per group, will be left in created regeneration openings greater than an acre in size. Leave at least 2 snags per acre, 3 downed logs per acre, and 5-7 tons of woody debris per acre. Estimates of percent canopy cover should be calculated in VSS 4-6 using the algorithmic relationship (Shepperd et al. 2001) that is relevant to northern Arizona ponderosa pine forests: Canopy Cover = -57.44 + 25.5047*LN(BA). Canopy cover should be averaged to a per-acre basis and averaged across the landscape. Canopy cover at the group level should be informed by the minimum stocking guidelines displayed in table 1-2.
1-6	No corresponding forest plan	In the 8,038 acres of habitat evaluated for

Amendment No.	Current Coconino NF Forest Plan Direction	Proposed New Guideline Language
	direction	the Wing Mountain project, natural meadows, wetlands, talus slopes, and other non-tree dominated areas may also occur as inclusions within the general forest; these inclusions will not be managed for forest conditions, and are not included within the uneven-aged stand structure.
1-7	No corresponding forest plan direction	In the 8,038 acres of habitat evaluated for the Wing Mountain project: Over time, the spatial location of the tree groups and interspaces may shift within the uneven-aged stand.
Vegetation Management – Within Post-fledgling Family Areas		
1-8	No corresponding forest plan direction	In the 8,038 acres of habitat evaluated for the Wing Mountain project, canopy cover at the stand level is measured within mid-aged to old forest structural stages groups (VSS 4, VSS 5, and VSS 6) and not within grass/forb/shrub to young forest structural stage groups (VSS 1, VSS 2, and VSS 3) or in interspaces, natural meadows and grasslands, or other areas not managed for forest conditions. Estimates of percent canopy cover should be calculated in VSS 4-6 using the algorithmic relationship (Shepperd et al. 2001) that is relevant to northern Arizona ponderosa pine forests: Canopy Cover = -57.44 + 25.5047*LN(BA). Canopy cover should be averaged to a per-acre basis and averaged across the landscape. Canopy cover at the group level should be informed by the minimum stocking guidelines displayed in table 1-3.
1-9	No corresponding forest plan direction	In the 8,038 acres of habitat evaluated for the Wing Mountain project, develop and maintain 10 -30% of the uneven-aged stand as interspaces between tree groups. Interspaces are the spaces between groups and clumps of trees (VSS 1-6) that are intended to be dominated by grass/forb/shrub vegetation and may include scattered individual trees.
1-10	No corresponding forest plan direction	In the 8,038 acres of habitat evaluated for the Wing Mountain project, tree group

Amendment No.	Current Coconino NF Forest Plan Direction	Proposed New Guideline Language
		spatial distribution may be highly variable based on local site and current conditions; the interspaces between groups may range from 20-200 feet, but generally between 25-100 feet apart from drip line to adjacent drip line. This spacing of groups is not affected by single trees in the interspace.
1-11	No corresponding forest plan direction	In the 8,038 acres of habitat evaluated for the Wing Mountain project, natural meadows, wetlands, talus slopes, and other non-tree dominated areas may also occur as inclusions within the general forest; these inclusions will not be managed for forest conditions, and are not included within the uneven-aged stand structure.
1-12	No corresponding forest plan direction	In the 8,038 acres of habitat evaluated for the Wing Mountain project, over time, the spatial location of the tree groups and interspaces may shift within the uneven-aged stand.

Table 1-2. Minimum Stocking Guidelines for Canopy Cover in Landscapes outside Goshawk Post-fledgling Family Areas

VSS Class	DBH Class (inches)	% of Area	Mean DBH (inches)	Group Basis (Mean)			Canopy Cover	Per Acre Basis (Mean)	
				SDI	TPA	BA/Ac		TPA	BA/Ac
1	0.0 – 0.9	10	0.1	0	203	0	NA	20.3	0
2	1.0 – 4.9	10	3	28	193	9	NA	19.3	1
3	5.0 – 11.9	20	8.5	105	136	54	NA	27.3	11
4	12.0 – 17.9	20	15	89	46	57	40	9.3	11
5	18.0 – 23.9	20	21	100	30	73	40	6.1	15
6	24.0 +	20	27	104	21	84	40	4.2	17
								86.5	**54**
	Per-acre basis and assumptions:							**Dq* =**	**12.3**
	Reserve trees and interspace are included in these figures. Trees are closely grouped, allowing for open interspace between tree groups. SDI maximum values = SDI/450 x 100. SDI, TPA and BA are inferred from the forest plan.							**SDI* =**	**92**
								* Includes trees ≥ 1” DBH only.	

Table 1-3. Minimum Stocking Guidelines for Canopy Cover in Landscapes within Goshawk Post-fledgling Family Areas

VSS Class	DBH Class (inches)	% of Area	Mean DBH (inches)	Group Basis (Mean)			Canopy Cover (%)	Per Acre Basis (Mean)	
				SDI	TPA	BA/Ac		TPA	BA/Ac
1	0.0 – 0.9	10	0.1	0	203	0	NA	20.3	0
2	1.0 – 4.9	10	3	28	193	9	NA	19.3	1
3	5.0 – 11.9	20	8.5	105	136	54	NA	27.3	11
4	12.0 – 17.9	7	15	137	72	88	60	4.8	6
4	12.0-17.9	13	15	130	68	83	50	9.0	11
5	18.0-23.9	20	21	127	39	93	50	7.7	19
6	24.0+	20	27	135	27	109	50	5.5	19
								93.9	**69**
	Per-acre basis and assumptions							**Dq* =**	**13.1**
	Reserve trees and interspace are included in these figures. Trees are closely grouped, allowing for open interspace between tree groups. SDI maximum values = SDI/450 x 100. SDI, TPA and BA are inferred from the forest plan.							**SDI* =**	**114**
								* Includes trees ≥ 1" DBH only.	

Non-Significance Evaluation: Significance was evaluated against the criteria in Forest Service Manual (FSM) 1926.51 and 1926.52. Factors include timing, location and size, relationship to forest goals, objectives, outputs, and management prescriptions. In terms of timing, the Coconino National Forest Plan has been in place (and amended) since 1987 and plan revision efforts are underway. While the amendment does provide clarification that has been lacking since the forest plan was implemented, it is specific to this project.

Suitable gohawk habitat on the Coconino NF encompasses about 791,897 acres (Green 2011, draft unpublished data). Approximately 8,038acres of goshawk habitat (non-PFA, PFA, dispersal PFA, and nest stands) located on the Forest is within the Wing Mountain project area. The amendment would affect 8,038acres within the project area. This acreage is 1.0 percent of all goshawk habitat on the Coconino NF. For this reason, location (confined to the ponderosa pine cover type) and size was determined to be non-significant.

Although the definition of interspace, the relationship between interspaces and VSS, and specifics for measuring canopy cover are addressed in this amendment, the environmental analysis and subsequent decision must address how forest plan canopy cover requirements in VSS 4 to 6 are met and how treatments move towards the desired VSS size class distribution. For this reason, the amendment is consistent with forest goals for wildlife and fish of managing habitat to maintain viable populations of wildlife and fish species and improve habitat for selected species (Coconino National Forest Plan, replacement page 22-1) and for improving habitat for listed threatened, endangered, or sensitive species of plants and animals and other species as they become threatened or endangered (Coconino National Forest Plan, replacement page 23).

The amendment would not impose requirements on the Coconino NF's future management of goshawk habitat as the amendment is specific to this analysis. Because forest plan canopy cover requirements would be met in VSS 4 to 6 and movement towards balanced age classes would occur, the amendment is consistent with the management emphasis of achieving diverse and healthy stands.

Outputs identified in the forest plan are associated with MBBF of sawtimber sales and products (meet demand for timber while reducing conflict with other resources), MBBF of firewood sold and free use (provide access to firewood), grazing capacity (MAUM) and permitted livestock use (MAUM). This amendment provides clarification and disclosure of methods for meeting forest plan requirements. It has no relationship to outputs or to the relationship between the level of goods (timber, firewood) and services. The amendment would not result in a change land productivity or timber suitability classification. The amendment would not affect decisions that have been made through separate analyses on grazing capacity or permitted livestock use. For these reasons, the amendment is considered non-significant.